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MR. W. NEWTON,
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(Assisted by several Scientific Gentlemen.)

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INDEX TO VOL. XXXVI.

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PATENTS, REPORTS OF RECENT.

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LONDON JOURNAL,

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No. CCXVIII.

RECENT PATENTS.

To Charles André Felix Rochaz, *of New-court, Saint Swithin's-lane, in the City of London, merchant, for improvements in the manufacture of oxide of zinc, and in the making of paints and cements when oxide of zinc is used.*—[Sealed 28th February, 1849.]

The distinctive character of this invention consists, first, in improvements on the furnaces and apparatus employed in manufacturing oxide of zinc, whereby white oxide of an uniformly perfect quality is obtained from the whole of the zinc, which is introduced into the apparatus either in a mineral or metallic state; secondly, the invention consists in obtaining, by the mixture of such white oxide of zinc with certain substances, a good bodied paint or pigment; and, thirdly, the invention consists in making cements, as hereafter explained, when using oxide of zinc.

In Plate I., fig. 1, is a vertical section of the improved furnace for converting zinc into white oxide; and fig. 2, is a vertical section of the same. A, A, are crucibles of fire-clay, with flat moveable covers, having at their centre a round aperture; B, B, are pillars of fire-brick, supporting the crucibles; C, C, are moveable slabs of fire-clay, serving as a roof to the furnace (which roof can be taken off when the crucibles are to be cleansed or replaced); D, is the opening of the fire-place; E, the ash-pit; and F, is the part of the furnace whereon the chimney is placed. *g*, are flues for conducting off the gases from the fire-place; *d*, is the fire-grate; and *f*,

are iron bars, supporting the grate. G, is a longitudinal flue, which receives the products from all the flues *g*; and H, is a space where the combustion of the vapours of zinc takes place, and which communicates, by the opening *u*, with the chamber K, L, where the oxide deposits itself. R, is the door of the chamber; and *m*, are sheets of iron or zinc, fixed across the chamber. *n*, *n*, are bands of hemp or other textile substance, hanging from the roof of the chamber in transversal rows, a short distance from each other, and at crossed intervals; so that the current, after passing through the spaces of one row, meets perpendicularly the bands of the next row. The lower ends of those bands are fixed on a piece of wood *s*; the upper ends of the bands come through the roof or ceiling, where they are fastened, and their ends enter into a zinc trough *t*, which contains water; and, in order to be able to shake the bands, from time to time, a rope or cord is fixed at each end of the piece of wood,—such ropes or cords being carried up through the ceiling, to allow of the workman raising and lowering the piece of wood, so as to shake the bands and free them from the oxide which has settled upon them.

Three or four of these systems of rows or curtains of bands will generally be sufficient; but their number, and that of the rooms or compartments L, with or without metallic screens, can be multiplied; and the last room or compartment has an opening or chimney, with a register for the regulation of the draft.

The first compartment of the chamber is constructed of masonry or sheets of metal, on account of the high temperature created there by the air and oxide on their issuing from the furnace; but there is great advantage in constructing the other rooms or compartments entirely of sail-cloth or other similar fabric; because then any the most convenient shape and dimensions, according to the particular premises, can be given to such chambers or rooms; and, especially, because it will then be easy to keep the roof and sides of this part of the apparatus constantly and abundantly watered, which is desirable. The oxide adheres more easily to the sides and bands, it falls quicker, and takes less space, and it can be detached from the roof and sides by simply beating them externally.

The mode of carrying on the operation is as follows:—The crucibles are first filled with metallic zinc, and the covers are placed on them; the openings *u*, are then stopped with bricks; and the fire is urged until the metal begins to sublimate: the bricks are then to be removed from the openings

u. The vapours issuing from the aperture of the cover ignite and oxidize by the contact of the air in the spaces H, H, H; the currents rushing in carry the products through the opening *u, u,* into the chamber K, where they encounter the metallic partitions *m,* which compel them to descend and rise again before they pass into the part L, through the free space left between the roof and the partition wall; and, after meeting with another metallic screen *m,* they traverse in succession a series of rows of moistened bands. The oxide settles on the roof, floor, sides, and other parts of the whole of the range of compartments; while the current, containing but an insignificant portion of oxide, issues out at the chimney. The crucibles are to be fed with molten zinc from time to time. At the beginning of the operation it is well to keep the covers on the crucibles, in order to increase the heat; but as soon as the whole of the furnace has become well heated by the flames of the fire underneath, and of the burning zinc, the covers may be removed. The vapours are evolved in greater quantity, and the operation goes on more rapidly; but during the whole of the operation, from the moment the zinc flames have begun to appear, concretions form themselves around the borders of the crucibles, or the orifice of the covers: these concretions are formed of oxide, which has not been carried away by the current. That oxide, alone, which is carried by the current into the chamber, is of good quality, while that which remains is coarse. The workmen should be careful to keep the orifices free from such concretions by means of a scraper, and to remove them, from time to time, from the furnace. This residuum is afterwards treated in the following manner:—It is first mixed with pulverized charcoal or coke, and the mixture is moistened and moulded into small cakes, or in a form similar to that of the interior of the crucibles. These are to be placed in the crucibles, and treated as has been done with regard to the metal,—with this difference, that the covers are to remain all the while on the crucibles. The shape of the crucibles may be varied: the patentee prefers them to be made shallow when only treating metal zinc; but when the residuum is also to be operated on by the same crucible, he prefers the shape shewn in the drawing. The process, above described, is accelerated and improved by forcing a thin sheet of hot or cold air on the surface of the melted and burning metal in the crucibles or pans;—this is done by adjusting to the mouths of the furnaces a door, which has, at the lower part, an aperture for the passage of the flat tuyere. This blast,

by impinging on and sweeping over the surface of the metal, diminishes materially the formation of concretions, and increases that of the vapours; while, at the same time, a minimum of air being admitted, the force of the current in the chamber is reduced, which saves the loss of oxide at the chimney. The peculiar character of this part of the invention consists in obtaining spaces H, over the crucibles or vessels A, as explained; also causing streams of air to impinge on the melted zinc; also the using of rows of bands; and likewise the using of woven fabrics in making the rooms or chambers.

The furnace, above described, could be used in the fabrication of oxide by the direct process, viz., the treatment of zinc ores; but the number of furnaces required would be great, as the crucibles hold but a limited quantity, and cannot be placed one over the other; he therefore prefers to use, for the treatment of zinc ores, two sorts of furnaces,—the first of which is based on the disposition of the crucibles in the Belgian method of distillation of zinc, but is modified, as will now be described.

Fig. 3, is the front of a furnace for producing zinc-white from zinc ores, furnished with crucibles, and having an adjoining chamber for the reception of the oxide; and fig. 4, is a vertical section, taken through the middle of the furnace. A, are the crucibles or retorts; B, are slabs of fire-clay, under thinner slabs of cast-iron; G, are pillars of fire-clay, separating the crucibles and supporting the slabs; I, are stoppers intended, during the charging and cleansing of the crucibles, to stop the openings of the passages into the chamber K, such as before described; and *m*, are metallic sheets, as in the former apparatus. At fig. 4, C, are stoppers, forming, with the front of the furnace and the upper and under slabs, the fourth side of the square spaces for oxidation, which open into the chamber K, by apertures left in the wall of the same areal section as the passages D, for oxidation; R, is the chimney; E, the ash-pit; *d*, the grate; and *f*, are iron bars supporting the grate. The compartments for receiving the oxide are similar to those above described.

The mode of operating is as follows:—When the crucibles or retorts have been filled with ore, roasted, and mixed with charcoal or coke, as usual, the stoppers A^1, which are made to fit in the orifice of the crucibles, are put in and luted all round, except at the upper part, where a slope exists for the passage of the vapours. As soon as the flames, issuing from that slope, assume the whiteness of zinc flames, the stoppers I, (fig. 3,) are to be removed, and the passages D, for oxidation,

are to be formed by putting in the longitudinal stoppers C, (fig. 4,) and luting them externally. The currents of air, entering at the further ends of the passages D, inflame the vapours and carry the oxide into the chamber K. During the whole of the operation a workman takes care to clear the apertures of the stoppers A^1, by means of an iron rod, crooked at one end: the concretions fall on the sole of the passages D, and are drawn out, from time to time, by the workman, who also pushes into the chamber K, the oxide which deposits itself in that part of the passages formed by the openings into the chamber K.

The cleansing and charging of the crucibles are effected in the manner well known to zinc-makers, as the Belgian method for distilling zinc; and the operation, when properly conducted, and with good ores, can be effected three times in 24 hours. The oxide, thus produced, is said to be in no way inferior to that obtained from the metal in the manner first described; but as, for the first hour after charging, the vapours are slow in evolving, and are mixed with foreign matter, it is advisable, during this period of the distillation, to collect the products apart, in order to preserve the uniformity of the general result. For this purpose, instead of the stoppers A^1, with slopes, which have been described, the retorts are each to be provided with a stopper, having a prominent ledge, to which is to be adapted a tube, similar to those used in the distillation of zinc. In this case, the stoppers C, (fig. 4,) are only to be put in one hour after the charging; then the tubes are to be taken off, and the stoppers I, are to be removed. In these tubes the zinc is collected in a metallic or in a grey oxide state. This mode of treatment is simple and economical, as it possesses not only the advantage of saving almost the whole of the expense of reducing zinc to its metallic state, but also of collecting that considerable quantity of oxide which, in the distillation of ores for the production of blue metal, oozes out, and is lost through various parts of the apparatus. The peculiar character of this apparatus consists in the arrangement of passages D, for oxidizing the zinc vapours, and conducting them into the chamber K.

Another method, which offers a great saving in fuel and other expenses, is described as follows:—Fig. 5, is a vertical section of a blast furnace, for obtaining zinc-white from zinc ores. A, A, are two passages, to receive the ores mixed with the fuel; B, B, are two passages, to receive charcoal or coke; C, are covers of the passages; and D, is a flue of oxidation, leading into the chamber K. The part E, will, at all times, be

full of charcoal or coke; the part F, is where the reduction and sublimation take place; G, is a cavity, into which the slags and residuum descend; H, tuyers; and *a*, is a moveable stopper in the oxidizing passage.

The following is the operation:—The ores, properly roasted and ground, are mixed with the usual proportion of coke or charcoal; and, when necessary, flux is to be added. The whole is afterwards moistened and shaped into small bricks or cakes, which are well dried. When the fire has been kept up for some time with pure coke, and the furnace well heated, the mixture of ores and fuel is to be introduced into the passages A; and the passages B, are to be filled with charcoal or coke. The blast of air, whether hot or cold, is forced in at the tuyers H, H: the volatile products find an outlet as soon as the stopper *a*, is removed. The vapours of zinc burn at that opening, and the oxide is carried through the passage or flue D, into a chamber K, such as above explained. The residuum of the production, and the lead, if there be any, contained in the ores, are drawn out through an aperture at the lower part of the cavity G. The peculiarity of this apparatus lies in the functions of the passages B, which form constantly a bed of incandescent coke in the part E, through which the gases and vapours have to find their way; and hence the vapours, which may have partially become oxidized by the excess of air supplied by the blast, are again reduced, and reach the opening *a*, in a pure state. When necessary, the patentee places, at the opening *a*, fire-clay partitions or divisions, so arranged as to stop or intercept the ashes or other particles of foreign matters which may be mixed with the gases and vapours. With respect to this part of his invention, the patentee remarks, that zinc-white has before been made; and various furnaces have been employed for such manufacture; and it has been proposed to use a blast furnace of an ordinary construction for such purposes;—he does not therefore claim the making of oxide of zinc, but only the peculiarities in the furnaces and apparatus herein described.

For the manufacture of zinc-white paints and pigments, the patentee combines zinc-white (in preference) with white marble, ground to an impalpable powder; and, when that substance cannot be procured, he supplies its place by having quick-lime exposed, under shelter, for a sufficient time for it to slake itself gradually, by slowly imbibing the water and carbonic acid of the atmosphere. He states that, if the hydrate of lime were employed shortly after it had been simply slaked, it would preserve an objectionable degree of causticity;

but when that causticity has disappeared, in consequence of gradual saturation by carbonic acid, the hydrate becomes the best substance which can be united with zinc-oxide; and the lime may be combined at the rate of from twenty-five to thirty per cent.

Another improvement in the preparation of paint, where zinc-oxide is used, consists in adding to this oxide, or to its mixtures with other bases, rosin or resinous matters,—turpentine and drying-oil being preferable. By diluting the whole in a sufficient quantity of spirits of turpentine to bring it to the degree of fluidity which may be required, a solid, fresh, unalterable paint is produced, which dries very quickly, and can endure the most frequent washings. The following are the proportions recommended:—For brilliant paint—to twenty parts, by weight, of base, six parts of rosin, two parts of turpentine, and one part oil, are added. For flat paint—to twenty parts of base, three parts of Burgundy pitch and one part of oil are added. In manufacturing cements, when zinc is used, the patentee takes the residuum from the crucibles, pots, or retorts, used in the manufacture of zinc, or of oxide of zinc, and mixes it with common mortar in the construction of walls and buildings:—the addition of such matter communicates to the mortar a high degree of hardness.—[*Inrolled August*, 1849.]

To Edward Ives Fuller, *of Margaret-street, Cavendish-square, in the county of Middlesex, carriage-builder, and* George Tabernacle, *of Mount-row, Westminster-road, in the county of Surrey, coach iron-founder, for certain improvements in metallic springs for carriages.*—[Sealed 7th July, 1849.]

The object of this invention of improvements in metallic springs for carriages is to obviate, as far as possible, the unpleasant effect of the recoil of carriage-springs when in action, and to prevent the liability of their breaking or becoming strained or injured by such recoil. The means adopted for obviating these inconveniences consists in connecting the springs at one or both ends to each other, when two springs are employed, or to a rigid bar, when only one spring is used, in such a manner that the ends of the springs may have sufficient play horizontally when they elongate or flatten by being loaded; so that their free action may not be checked suddenly, as sometimes happens when the ends of the springs are connected together, after the ordinary manner, by slings.

In Plate II., several plans of carrying out the invention, and adapting it to various forms of springs, are shewn. Fig. 1, represents the invention adapted to a double elliptical spring. At one end the springs are jointed together in the ordinary manner; but, instead of connecting the opposite ends of the springs together by means of shackles or slings, as usual, a slotted box or bearing *a*, is secured to the end of the under spring, and the upper spring is furnished with a sliding stud or bolt *b*, which works in the slot of the bearing *a*. In order that the construction of this bearing may be clearly understood, it is shewn detached, and upon an enlarged scale, at figs. 2, and 3. Fig. 2, is a longitudinal section, taken through the bearing, shewing the stud or bolt *b*, in the slot; and fig. 3, is a cross section of the same. It will be seen that the under side of the box or bearing *a*, is recessed or cut away for the purpose of receiving the end of the lower spring *c*, which is secured therein by means of a bolt or rivet *e*. On the under side of the upper spring *d*, a forked arm *f*, is made; and a horizontal pin *g*, at the lower end thereof, passes through the sliding stud or bolt *b*, (figs. 2, and 3,) which works in the slot of the bearing *a*. It will now be seen that as the springs *c*, and *d*, are pressed together by the load, the stud or bolt *b*, will be slidden along the slot, which is made long enough to preclude the possibility of the stud b^1, striking against the end of the slot, and producing any recoil. At fig. 4, a slight modification of the above is shewn;—the only difference being, that the upper elliptical spring is curved round at the end; and the sliding stud *b*, is connected to the extremity of the scroll, instead of being attached to the underside of the spring, at some distance from the end, as shewn at fig. 1. Fig. 5, exhibits the principle as applied to a demi-elliptical spring. In this instance there is only one spring, viz., the lower spring *c*. One end of this spring is jointed to the end of a curved rigid bar *d*; and the other end is furnished with a pin *b*, which slides in a slot made in the end of the rigid bar *d*. Fig. 6, is a modification of this plan,—the principal difference being, that in place of making a slot in the end of the rigid bar *d*, as in the former instance, the end of the rigid bar is scrolled and carries the pin or stud *b*, which works in the slot of the bearing *a*; which, in this case, is bolted to the under spring *c*, as in figs. 1, and 3.

Fig. 7, represents a spring with the improvements applied thereto, and adapted to the shaft of a light vehicle, such as a gig or light cart. The spring *c*, is attached, at one end, to a scroll-iron *j*, which is secured to the end of the shaft; and

the opposite end of the spring is furnished with a slotted box or bearing *a*. A second scroll-iron *k*, also fastened to the shaft, carries, at its lower end, a stud or bolt *b*, which works in the slot of the box or bearing *a*, as in fig. 6.

Fig. 8, shews a plan in which the slotted box is dispensed with. In this case, the end of the spring *c*, is made to work between two flat pieces of metal *i*, *i*, which are mounted on centres in the forked ends of the scroll-iron, as shewn in the enlarged detached views figs. 9, and 10. In connecting common carriage-springs according to this invention, it will be generally found advisable to attach the two springs together at one end by a common joint, as shewn in the figures, so as to leave all the horizontal play for the other end of the springs; but, in some cases, when the springs are secured to the axle-trees or boxes at or near their middle, such as for railway purposes, it will be found desirable to allow play at each end of the spring.

Fig. 11, represents a side elevation of a railway carriage, with the improvements adapted thereto. It will be seen that the springs *c*, *c*, are secured, at their middle, between the horns *l*, *l*, in such a manner that they shall have vertical play in the slot or space between the horns; and that each end of the springs is furnished with a stud or bolt *b*, which works in the slots of the bearings *a*, precisely as shewn at figs. 1, and 3. If thought advisable, this plan of mounting springs may, with suitable modifications, be also adapted to heavy carriages for ordinary roads; and, if preferred, the slotted box or bearing *a*, may be attached to the springs, and the bolts or studs *b*, to the carriage framing, instead of the arrangement shewn in the drawing.

Fig. 12, represents another mode of connecting the ends of carriage-springs. In place of shackles or slings usually employed, or the slotted bearing *a*, and sliding stud or bolt *b*, above described, the patentees, in some cases, secure the ends of the springs respectively to the fulcrum and one end of a bell-crank lever, in such a manner that the lever may work freely on these points. The right-hand end of the lower spring *c*, carries the fulcrum-pin of the bell-crank lever *h*; and the corresponding end of the upper spring *d*, is connected to the outer corner of the bell-crank lever. It will now be understood that, as the upper spring *d*, becomes loaded, and thereby elongated or flattened, by being brought more nearly to a straight line, the bell-crank lever will be made to turn on the stud *n*, of the lower spring; and, as the end of the under side of the upper spring is supported by the segmental arm

of the bell-crank lever, that part of the spring which is in contact with the lever will become rigid, and its elasticity prevented from coming into play; so that, as the weight or load on the spring is augmented, the rigidity or strength of the spring will be increased by shortening the length of the elastic part of the spring.

The patentees claim, First,—connecting springs together at their ends by means of sliding-pins, bolts, or studs, attached to the end or ends of one spring, and caused to work in a slot or groove, made in a box or bearing, attached to, or formed in or on, the other spring,—also connecting the ends of springs to rigid bars, or rigid scroll-irons, by similar means. Secondly,—the means shewn at fig. 8, or any mere modification thereof, in which the end of one spring is made to rest and work on or between a metal bearing, mounted in a forked end or frame, attached to the other spring, so as to afford sufficient horizontal play to the springs, without the danger of unpleasant effects from recoil. Thirdly,—the plan shewn at fig. 12, or any mere modification thereof, for connecting springs together by means of a bell-crank lever or sector-piece, so as to increase the tension or rigidity of the spring as the weight is increased, as well as to obviate any unpleasant effects that might arise from recoil, and which cannot take place with the above-described arrangement.—[*Inrolled January,* 1850.]

To David Smith, *of the City of New York, in the United States of America, lead manufacturer, and a citizen of the said United States, for certain new and useful improvements in the means of manufacturing certain articles in lead.*—[Sealed 29th May, 1849.]

This invention consists in causing the fused metal to fall through an ascending current of air, which is made to travel at such a velocity that the dropping metal will, in its descent, come in contact with as great a volume of air in a short tower as it would meet in falling through the high towers heretofore found necessary to such purposes;—by this means it is stated that the manufacture of shot may be effected with less outlay and current expense than heretofore; and, at the same time, shot of a superior quality may be produced.

The figure in Plate II., represents, in vertical sectional elevation, a sheet-metal cylinder, set up as a tower within a building, and intended to be used for the purpose of casting shot. It may be of about twenty inches internal diameter

for each fifty feet of height, or nearly in such proportions for other heights. A, is a water cistern, forming as it were a base to the tower or column B. At the lower end of this tower is an annular chest *a, a,* the central opening of which forms a portion of the passage for the descending shot. *b,* is a pipe, proceeding from a blowing apparatus, and leading to the chest *a,* with which it is connected, for the purpose of supplying a blast of air to that chest,—the upper face *c,* of which is pierced with holes, to pass and disperse the air up the column B. This column, at its lower end, takes the form, for a short distance, of a truncated cone; it then assumes the cylindrical form, which it retains to the height of the line *d, e*; and from thence, to its upper extremity, it gradually increases in diameter (like a trumpet mouth), for the purpose of passing the ascending blast through a frame *f, f,* which supports a cylindrical standard *g*. The upper central portion of this standard receives the pouring-pan *h,* which is made changeable for each separate size of shot (the diameter of the shot being determined by the size of the holes in the bottom of the pan as usual); and round the pouring-pan *h,* is a circular waste-trough *i*. The intent and effect of this arrangement is, that the fluid metal running through the pouring-pan *h,* into the ascending current of air in a tower of fifty feet high, when the air is passing up with twice the velocity of the descending metal, will be operated upon to the same, or even to a greater extent, by the air, than if the metal fell through the stagnant air in a costly tower of one hundred and fifty feet, or more, in height; and so on in the like proportions, with greater or less velocities of the ascending current of air. The particles of metal fall through the open centre of the air-chest *a,* into the water in the cistern A, where, for convenience, a shoot *k,* carries the particles of metal into a tub *l,* which may be placed empty, and removed, when full, through a scuttle in the cover of the cistern.

Instead of forcing a blast of air up the tower B, the desired effect may be obtained by exhausting the upper end of the tower by a fan-wheel, or other suitable exhauster, as will be well understood. In that case, the air-chest *a,* may be dispensed with; and, instead thereof, vents must be made at the bottom of the tower, to allow of air rushing in, to fill up the vacuum created by the exhausting apparatus.

The patentee claims the application of an ascending artificial current of air to the cooling of the descending metal in the manufacture of drop-shot.—[*Inrolled November,* 1849.]

To STEPHEN TAYLOR, *of Ludgate-hill, in the City of London, Gent., for an invention of certain improvements in the construction of fire-arms, and in cartridges for charging the same,—being a communication.*—[Sealed 10th December, 1847.]

THE first part of this invention relates to the ball and cartridge for fire-arms, and consists in making the ball hollow and open at the rear end to receive the charge, which is closed in by a cap provided with a touch or match-hole, through which the contained charge is to be ignited.

The second part of the invention relates to improvements in "repeating" fire-arms, in which the improved balls and cartridges, or any other construction of balls and cartridges combined, are to be used.

In Plate I., fig. 1, is an elevation, and fig. 2, an end view of the improved combined ball and cartridge *a*, the forward end of which is elongated, to facilitate its passage through the air, and the rear end is cylindrical and hollow, as shewn at *b*, in fig. 4, to receive the charge of powder, which is confined therein by a cap *c*,—a hole being made in the centre thereof, through which the charge is to be ignited. To facilitate the discharge, gun-cotton or other combustible or explosive matter may extend from the powder in the ball through the said hole, as shewn at *d*, fig. 2, the better to insure the communication of fire from the priming. It will be obvious that the forward end of the ball may be shaped in any desired manner, although the form represented in the drawings is preferred.

Fig. 3, is a side view of the improved gun; fig. 4, a longitudinal vertical section of the same; fig. 5, is a side view of the breech, with the lock-plate removed; and fig. 6, is a like view of the lock, removed to shew the internal parts. The other detached views will be hereafter referred to, when the parts they particularly exhibit are being described.

Below the gun-barrel *e*, (which is made in the usual manner), and parallel therewith, is another barrel *f*, which is denominated the magazine: the bore thereof is somewhat larger than the bore of the barrel, that the cartridge may slide therein with facility. The forward end *g*, of this magazine, is made separate, and turns on a journal-pin *h*, that it may be turned out of the line of the magazine for the insertion of the cartridges and the charger, to be presently described. The rear end of this hinged piece is provided with a latch *i*, to secure it in place when in a line with the main part of the magazine. The part *g*, being opened, the required number

of cartridges are placed in the main part of the magazine, and the charger *j*, is inserted in the part *g*: the magazine is then closed, and the butt of the gun slightly depressed, to permit the charger to descend, by gravity, until its rear end rests on the cartridges. So long as the charger is in the part *g*, the latch *i*, will not close, because it is made with a projection which rests on the charger; but as soon as the charger runs back into the main part, the spring of the latch forces the catch down and keeps the magazine closed. The peculiar construction of the charger will be seen on referring to the longitudinal section (fig. 4,) of the gun, and to the supplemental figure 4*a*, which is a sectional plan of the same. The outer part of the charger *j*, is a metal tube, provided with a feather *k*, (see also the cross section, fig. 7,) which is taken in the line A, *a*, of fig. 3. This feather slides in a groove in the magazine, to insure the proper position of the charger during its passage along the magazine. The rear end of the charger, that is, the end which bears against the cartridges, is provided with a jointed piece *l*, which has a projection or catch *m*, on its upper surface. This catch engages the teeth of a stationary ratchet *n*, by which the charger is prevented from moving back towards the muzzle of the gun, so long as the gun is held with the magazine below the barrel; but when reversed, the weight of the jointed piece *l*, will liberate the catch and permit the charger to run out. Within the tube *j*, of the charger is a follower *o*, which slides therein freely, and is made with a shoulder *p*, at each end; and the cylindrical part between the shoulders slides in a collar *q*, attached to the outer tube *j*. Between this collar and the forward shoulder there is a helical spring *r*, the tension of which always tends to keep the follower towards the forward end, and therefore to force the outer tube *j*, towards the rear end of the magazine, and press upon the cartridges. The rear end of the follower is provided with a jointed catch *s*, similar to the one on the outer tube, the catch part of which passes through a slot in the outer tube *j*, that it may engage the teeth of a ratchet-bar *t*, which slides in a groove by the side of the stationary ratchet *n*, before described. It will be obvious, from the foregoing, that when the sliding ratchet-bar is drawn back by means of the catch *s*, the follower will be drawn back with it, and, by the intervention of the helical spring, the outer tube also—which will thus force all the cartridges towards the rear end of the magazine,—and that when the cartridges can no longer move back, the sliding ratchet-bar may complete its back motion with the follower, by reason

of the interposed spring, which is thus contracted, and retains a force to act on the cartridges so soon as the position of the other parts of the apparatus will permit. It will also be obvious that whatever back motion is given to the outer tube of the charger will be retained, by reason of the jointed catch *m*, engaging the teeth of the permanent ratchet. For the purpose of giving the required motions to the sliding ratchet-bar *t*, that bar is jointed, at its rear end, to a sliding trigger-bar *u*, which is adapted to slide in the breech of the gun, and provided with a finger-hook or ring, by which it is operated. At the back of the magazine a carrier *v*, is provided, of the form of a segment of a cylinder, adapted to receive and sustain the cartridges, one by one, as they are forced back by the charger. This carrier (which slides freely up and down between ways *w*, in the breech-plate *x*, and is shewn, in its elevated position, in the cross section, fig. 8, taken in the line B, *b*, fig. 3,) is moved up and down by a lever *y*, that turns on the axis of a pinion *z*, to be presently described. The form of this pinion is represented in the separate fig. 9. The trigger-bar is provided with rack-teeth a^1, on its upper surface, which engage the cogs of the pinion, and give to it the required reciprocating movements. After a cartridge has been deposited or forced on to the carrier, the trigger-bar is forced forward, which causes the pinion to rotate in the direction of the arrow, fig. 5; and, in its rotation, a cog b^1, (see fig. 9,) which, in its longitudinal direction, is larger than the others, strikes a pin c^1, on an arm of the lever *y*, which causes the carrier to raise the cartridge in a line with the bore of the barrel; and, to ensure this, the upward motion of the lever *y*, is assisted by a spring d^1. When the parts are in this position, the trigger-bar is drawn back, which rotates the pinion in the direction the reverse of the arrow, and communicates motion to a sliding breech-pin d^1, above, provided with cogs for this purpose; and, as this breech-pin is thus pushed forward, it forces the cartridge from the carrier into the barrel; and, so soon as it has entered the barrel, the carrier is at liberty to descend, to receive another cartridge;—its downward motion being effected by a pin e^1, (see figs. 10,) on the sliding breech-pin, which strikes and acts on a cam-formed plane f^1, of the lever; and, as soon as it is entirely depressed, this cam-formed part of the lever *y*, runs in a plane parallel with the line of motion of the breech-pin, that the pin e^1, which depresses the lever, may run thereon during the remaining portion of its motion, to hold down the carrier. It is necessary, or rather important, as the breech-pin begins to move forward, that the carrier

should be securely held in its elevated position, to ensure the entrance of the cartridge into the barrel; but, so soon as the cartridge has been partly inserted in the barrel, then the carrier should be at liberty to descend by the means before described. This holding up of the carrier is effected by a pin g^1, on the lever y, which, as it is elevated, enters a groove h^1, (see dotted lines, fig. 4,) in the side of the breech-pin; and, as this groove then runs in the line of motion, the pin remains therein so long as the carrier is to be held up,—that is, until the pin has reached the end of the horizontal portion of the groove; but, when it takes a right-angled turn, the pin of the lever drops out of the groove and allows the lever to fall, and, with it, the carrier v. So soon as the breech-pin reaches the end of its forward movement, a projection i^1, on the rear end of the trigger-bar (see the dotted lines of fig. 4, and also the detached view, fig. 4b,) strikes an arm j^1, of a lever k^1, that turns on a fulcrum-pin l^1, and forces the forward end of this lever up to the back of the heel of the breech-pin,—whereby a stop or abutment is given to the breech-pin, to resist the force of the explosion, and prevent its recoil. To give this lever or abutment the required strength to resist the recoil, in addition to the support which it receives from the fulcrum-pin, its rear end is rounded, and fitted to a socket in the breech-piece of the lock. As the abutting-lever k^1, can only be elevated after the breech-pin has been forced to its place in the barrel, and the trigger-bar, which operates the abutting-lever, also gives motion, by means of the pinion, to the breech-pin, it becomes necessary to arrest the pinion while the trigger-bar continues its motion;—this is effected by making the rack on the trigger-bar so short that, at the required time, it shall cease to operate the pinion; but, as the pinion and breech-pin must be held in this position while the abutting-lever is carried up, this is effected by making a longitudinal fillet m^1, on the trigger-bar, which runs in a groove cut in one cog n^1, of the pinion; so that, during the remaining motion of the trigger-bar, this fillet slides in contact with the tips of the two cogs of the pinion, on each side of the grooved cog n^1. On the return motion of the trigger-bar, preparatory to a repetition of the operations above described, the abutting-lever must first be depressed, which is effected by a projection on the rear end of the trigger-bar, that runs on a fillet projecting from the back face of the abutting lever (see figs. 4, and 4b.) Towards the end of the back motion of the trigger-bar, by which the cartridge is inserted in the barrel, the hammer o^1, of the lock is liberated by a projection p^1, on the trigger-bar,

which strikes the cam of the locking-piece q^1, (as shewn by dots at fig. 5,) and liberates the tumbler r^1, that the tension of the main-spring s^1, may force down the hammer into the position shewn at fig. 6, and discharge the piece. Just at the back of the magazine there is what may be termed a jointed stop, which is simply a lever a^2, (shewn best in the cross section, fig. 8,) the lower arm of which is curved, and the upper arm straight; so that, when the carrier is elevated, it bears against the straight arm, which throws the curved part across the bore of the magazine, and prevents the cartridge from being forced back; and, as the carrier descends, the curved arm is struck by the under surface of the carrier, which is recessed to receive it, and thus depresssed, to permit a cartridge to pass on to the carrier.

The operation of priming the piece is effected in the following manner:—In the top of the breech there is a reservoir (see the sectional view, fig. 5*,) which contains as many pills of percussion-powder as the magazine contains cartridges. This reservoir is provided with an appropriate turning cover; and, in the bottom, there is a large hole, which permits the pills or grains to drop freely into a hole in a rotating or vibrating plate u^1, let into a recess in the inner face of the top plate of the breech (see figs. 10, which shew a reverse view of this part of the breech and top of the breech-pin). This rotating plate has an arm v^1, which, as the breech-pin is moved back, is struck by a pin w^1, on the breech-pin (see fig. 4 *b*,), and rotated so far round as to bring the hole in the rotating plate to coincide with the touch-hole or pan x^1, in the upper surface of the breech-pin, that a pill may drop therein: and when the hole in the plate u^1, coincides with the touch-hole, it is under the bottom of the reservoir, to prevent more than one pill from passing into the touch-hole. As the breech-pin is moved forward, preparatory to a discharge, the touch-hole leaves the rotating plate, and is carried until it coincides with a hole y^1, in the upper breech-plate, through which the hammer strikes; and, during this forward movement of the breech-pin, another pin z^1, strikes the arm of the plate, to rotate it far enough to receive another pill from the reservoir, preparatory to another operation. The hole in the rotating plate should be of the required size to receive one pill at a time, and no more. The upper surface of the breech-pin should be as perfectly level as possible, and well fitted to the under surface of the breech-plate, to prevent the communication of fire from the touch-hole to the reservoir.

The patentee claims, First,—making balls for fire-arms

hollow at the rear end, to receive the charge of powder, and provided with a cap, to retain it therein, and pierced, for the passage of the fire from the priming, substantially as described; and this he claims irrespective of the form of the forward part of the ball, and of the cap for confining the charge therein. Secondly,—the employment, in combination with a magazine for containing the cartridges (and which communicates with the barrel). of a sliding charger, operated substantially as herein described, for the purpose of forcing the cartridges, as they are required, towards the rear end of the magazine, as described. Thirdly,—making the charger in two parts, connected by a spring, and working substantially as herein described,—whereby any difficulty arising from irregular working or yielding of the parts, will be avoided, and by which also the transfer of the cartridges to the carrier is ensured. Fourthly,—the employment of the carrier for receiving the cartridges from the magazine and elevating them to the barrel, substantially as herein described, when this is combined with the magazine and barrel, as described. Fifthly, —the sliding breech-pin, in combination with the carrier, as described, for forcing the cartridge from the carrier into the barrel; and, in combination therewith, the stop or abutting-lever, which prevents the recoil of the breech-pin. Sixthly,—combining the carrier, the breech-pin, and the abutting or stop-lever, with the sliding trigger-bar, substantially as herein described, whereby all the movements of all these parts are effected by the motions of the trigger-bar, as described. Seventhly,—the longitudinal fillet on the trigger-bar, in combination with the pinion, having one cog grooved, for the passage of the said fillet; by means of which, the pinion is made to retain the sliding breech-pin in place, while the trigger-bar completes its motion, to discharge the piece and to elevate the stop or abutting-lever, as described. And, Finally, —the stop, which prevents the passage of the cartridges from the magazine, when this is combined with the carrier and magazine, substantially as described.—[*Inrolled June,* 1848.]

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, civil engineer, for an invention of improvements in boilers or steam generators,—being a communication.*—[Sealed 17th April, 1849.]

THIS invention relates to improvements in that class of boilers or generators in which water-tubes are used instead of flue-

tubes,—the water passing through the tubes, and the heat circulating outside of them.

In Plate II., fig. 1, is a longitudinal vertical section of what is generally known as a locomotive boiler, with the improvements adapted thereto; fig. 2, is a transverse vertical section of the same, taken through the centre of the fire-box; fig. 3, is another transverse section, taken in the line 1, 2, of fig. 1; fig. 4, is a longitudinal vertical section of a modification of the improvements; and fig. 5, is a longitudinal vertical section of another modification of the invention, as applied to a stationary boiler. Fig. 6, represents, in cross section, a boiler, with the tubes placed transversely instead of longitudinally.

The principle of the first part of the invention, and that which distinguishes it from all other tubular boilers, consists in making the tubes or pipes, through which the water circulates, and which open at both ends to the body of water in the boiler, with a curve or bend upwards at one end; by means of which ample allowance is made for the unequal expansion of the tubes and the parts to which they are attached; and a more rapid and perfect circulation of water over the heated surface of the metal is also obtained; the effect of which is,—that the heat is quickly taken up, and steam is rapidly evolved; and at the same time the water is prevented from being driven out of the tubes and endangering the burning of the metal.

The second part of the invention consists in arranging the tubes with the curved or bent-up ends towards the most intense heat, that is, towards the furnace; so that the water may circulate in the reverse direction of the current or currents of the heated products of combustion. By this means the circulation of water through the tubes or pipes is increased; whilst, at the same time, the heat is applied more effectively and economically.

The last part of the invention consists in extending the upper ends of the tubes above the upper surface of the roof, crown, or other plate, to which they are attached; so that the ebullition and evolution of steam may be carried nearer to the surface of the water.

In the several figures of the drawing, *a*, represents the external shell of the boiler, which may be of any desired form, and *b*, the fire-chamber. Within the shell is arranged a series of water-tubes or pipes *c*, which are secured at the back end to a vertical plate *d*, which is at such distance from the end-plate or head *e*, of the boiler, as to leave a space *f*,

for the free admission of water to this end of the tubes or pipes. The other ends of the said tubes or pipes are curved or bent upwards and attached to the roof or crown-plate *g*, which is connected at the back end with the plate *d*, before described; its connection at the front end is with a vertical plate *h*, or lining of the furnace, and at the sides with the upper edges of a plate *i*, within the boiler, and at such distance from it as to leave a water-space *j*, all around, and communicating with the space *f*, at the back end, and with the water-spaces *k*, surrounding the furnace, as shewn in the transverse section. This plate *i*, together with the roof or crown-plate, constitutes the fire-flue, which leads from the furnace to the chimney *l*; so that the flame and other products of combustion, in passing from the furnace to the chimney, act first on the curved or bent part of the tubes or pipes, and then, in passing towards the chimney, act on and impart heat to the external surface of all the water-tubes or pipes,—the most intense heat being applied to the curved or bent ends of the tubes which first receive the action of the heat. The products of combustion also heat the plates *g, h, i*, which constitute the inner shell of the water-space surrounding the flue. The tubes are curved or bent upwards (as shewn); and the water in them, being heated and rarified, will tend to rise in the curved ends and thus establish a rapid circulation through their entire length; and as their outer end is connected with the body of water at the back at *d*, and where the water is not heated to so intense a degree, the required circulation in the tubes or pipes will be effected. By thus establishing and keeping up a constant and rapid circulation of water through the boiler, the effect will be to take up and absorb the heat from the surface of the metal with great rapidity; and, as the curved and bent ends of the tubes are either directly over or nearest to the fire-chamber, they will be more highly heated than the rear ends; so that the water, by its circulation through the tubes or pipes, will move in a direction the reverse of the current of heat, as it passes from the fire-chamber to the chimney;—thus increasing the absorption of heat by the water. For the purpose of delivering the steam nearer to the surface of the water, the curved ends of the tubes or pipes are extended above the roof or crown-plate *g*, as at *m*, figs. 1, and 2; so that a greater depth of water can be maintained above the roof or crown-plate;—thus lessening the liability to explosions, to which it would otherwise be exposed by reason of the action of the heat on the roof without the presence of water: for the water may sink

below the upper ends of the tubes without impeding the circulation; as the water is not received but only delivered at this end of the tubes or pipes. The shell of the boiler, at the horizontal end of the tubes or pipes, may be perforated, as at *n*, with a series of holes, corresponding with the bore of the tubes (or with one large hole for the whole series), covered with a plate *o*, in the manner of a man-hole, for giving access to the tubes or pipes, for cleansing or repairing them, when required.

Instead of making the tubes or pipes in one single series from end to end, they may be made in two or more series, as represented at fig. 4,—the curved or bent-up ends of each series being towards the furnace, and the first series extending over the fire-chamber. Or they may be arranged as represented at fig. 5, where they are employed to connect different portions of the length of a cylindrical or other form of boiler;—the curved or bent-up ends of the tubes or pipes being made to pass up through the bottom of the boiler, and the horizontal ends being connected with a water-well or leg, as at *p*, of any form desired, so that the water may enter this end of the tubes or pipes, to supply the circulation. Or the rear ends of the tubes or pipes may be curved or bent up and passed through the bottom of the boiler, as at *q*, in the same figure;—the forward ends, however, being extended up to a higher level, as at *r*, to ensure the circulation towards the highest end, and that which first receives the action of the heat. Or the tubes may be arranged transversely, as represented at fig. 6.

The inventor remarks, that the first part of his invention, viz., the employment of tubes with curved or bent-up ends, will be found advantageous without the second and third parts. In such case, the tubes may be arranged transversely, as represented at fig. 6, with the curved or bent-up ends passing through the roof or crown-plate, and the horizontal ends through the inner plate of the side water-space.

The third part of the invention may also be employed without the first and second parts; as the extension of the upper ends of the tubes above the surface of the plates, to which they are attached, is irrespective of their form and location; but when all the parts of the invention are employed in connection, the best results are said to be obtained.

The patentee claims making the water-tubes or pipes of a steam-boiler or generator with one of the ends curved or bent up,—both ends of the said tubes or pipes being made to communicate with the body of water in the boiler.—[*Inrolled October*, 1849.]

To Charles James Anthony, *of the City of Pittsburgh, in the United States of America, machinist, for certain new and useful improvements in the means of treating unctuous animal matter.*—[Sealed 7th June, 1849.]

This invention relates to the construction of churns, and consists in forming cavities in the dasher-wings, arms, buckets, or strikes, so as to introduce a larger quantity of air into the cream or milk at each revolution or stroke of the dasher than is done by the ordinary dashers, and thereby to oxidize the unctuous portions of the cream or milk more speedily, and effect the separation thereof from the aqueous portions. The patentee states that, by means of his invention, a larger quantity of butter, of better quality, can be more speedily obtained from a given quantity of cream or milk than can be effected by the churns heretofore constructed;—and he also states that, by means of it, milk may be churned within three hours after it comes from the cow.

In Plate III., fig. 1, exhibits a box-churn; fig. 2, is a plan view of an improved rotary dasher, to be used in the same; and fig. 3, is a vertical section of the dasher, which, it will be seen, is formed with a series of cavities *a, a, b, b,* in its upper and under surfaces. Fig. 4, is a plan view, and fig. 5, an end view, of another form of rotary dasher, consisting of two frames, fixed at right angles to each other: each frame is composed of two pieces *c, c,* connected together by bars *d, d*; and in each of the pieces *c*, two cavities *a, b,* are formed, one on each side of it, as will be readily understood on referring to fig. 6, which represents a longitudinal section of one of the pieces *c*. The action of the cavities *a, b,* in each form of dasher, is stated to be as follows:—On rotary motion being given to the dasher, those cavities *a,* which are at the time descending, will carry downwards and force into the cream or milk a certain portion of air; while the corresponding cavities *b,* on the other side of the dasher, will act, by suction, to draw downwards a portion of air into the cream or milk; and, as the rotation continues, the before-mentioned cavities *a,* will lift or throw up a portion of the cream or milk into the upper part of the churn, and the corresponding cavities *b,* will suck or draw up a like portion of cream or milk;—the object of these actions being to effect as rapid and perfect an admixture of air and cream or milk as possible, and thus accelerate the separation of the butter.

The patentee claims, as his invention, the introduction of cavities or a cavity in the dasher-wings, arms, buckets, or

strikes of churns or machines used in churning; whether operating with a rotary, or vertical, or horizontal motion; and whether those cavities be large or small; and whether they be formed or made in the upper or lower surface, or partly in the upper and partly in the lower surface of the dashers or wings, arms, buckets, or strikes, as shewn at figs. 2, 3, 4, 5, and 6; or whether formed or made in alternate arms, buckets, or strikes; or whether the cavities or cavity be formed or made in one-half, or in any larger or smaller part or portion of the dasher, or in any one or more of the arms, buckets, or strikes, or in any larger or smaller part or portion of them, or in or of whatever number, form, construction, position, or dimensions such cavities be made; as he does not confine his claim to the number, form, construction, position, or dimensions of the cavities.—[*Inrolled December,* 1849.]

To Pierre Augustin Chauffourier, *of Regent's-quadrant, in the county of Middlesex, merchant, for improvements in castors,—being a communication.*—[Sealed 4th July, 1849.]

This invention relates to that kind of castor in which a ball or sphere is substituted for the ordinary wheel or roller; and it consists in such an arrangement of parts, that a ball or sphere, composed of three pieces, shall be capable of rotating on pivots or axes carried by the horns or branches of the castor, and, at the same time, can rotate freely in a direction at right angles to the first-mentioned rotary movement.

In Plate III., fig. 1, is an elevation of one of the improved castors; fig. 2, is a vertical section of the ball; fig. 3, is a plan view of the central portion of the ball; and fig. 4, is a detached view of one of the pivots. The ball or sphere is composed of two hemispherical parts *a*, *b*, and of a centre-piece *c*, which is a circular plate or disc, with two sockets *d*, *d*, one at each side thereof, for the reception of the pivots by which the ball is connected with the branches *e*, *e*, of the castor. The parts *a*, *b*, are rivetted to the ends of a spindle *f*, the enlarged central portion of which fits into a circular opening in the centre of the plate *c*, and is capable of turning freely therein. *g*, *g*, are two screw-pivots, which are screwed into suitable openings in the branches *e*, *e*; and the reduced ends or points of the pivots enter into the sockets *d*, *d*, of the centre-piece *c*. If the article of furniture, to which the castor is applied, be drawn forward or pushed backward in a straight line, the ball will rotate only around a line passing through

the centre of the two pivots; but if the article be moved in a direction varying, more or less, from that just mentioned, then the ball will also rotate around a line passing through the centre of the spindle *f*; and therefore, in this case, the ball or sphere will have a movement compounded of these two motions.

The patentee claims, Firstly,—the constructing a metal ball in three separate segments or hemispheres, and the setting of two hemispheres on the axis crossing the central segment, to obtain a rotative motion, as hereinbefore described,—reference being had to figs. 1, and 2, of the drawing. Secondly,—the construction and mechanical arrangements of the central segment, to obtain, in combination with the two hemispheres, two rotative motions crossing each other, as hereinbefore described,—reference being had to the figures of the drawing.—[*Inrolled January*, 1850.]

To Daniel Miller, *of St. George's-road, in the City of Glasgow, Scotland, civil engineer, for certain improvements in the mode of drawing ships up an inclined plane out of water.*—[Sealed 5th June, 1849.]

This invention relates to an improvement in connection with what is commonly known as "Morton's patent slip," on which vessels are drawn out of the water for the purpose of undergoing repairs, and which formed the subject of a patent granted to Thomas Morton, March 23rd, 1819. Morton's slip consists of three rails, fixed on suitable bearers, and extending up a sloping beach from low-water mark to a point above the reach of the tide. On these rails a large frame or carriage travels, having a number of trucks or rollers beneath it, of sufficient strength and suitably mounted to run upon the three rails and sustain the weight of the carriage and the ship intended to be repaired. The ship is securely fixed upon the carriage, and is then hauled up to the top of the slip by an arrangement of wheel-work (actuated by manual labour or other power) connected with the carriage by a series of strong traction-rods.

Now, the present invention consists in the application of apparatus, constructed on the principle of the hydraulic press, for drawing the carriage and ship up the inclined plane of the slip, instead of employing the wheel-work heretofore in use.

In Plate III., fig. 1, is a side elevation of the new machinery; and fig. 2, is a longitudinal section of the hydraulic

cylinder and ram of the same. *a*, is the hydraulic cylinder, which is securely fixed at the upper part of the slip, in a line with the centre rail thereof; and it is provided with a moveable ram *b*, which works through cupped leathers at the neck or end of the cylinder (as usual in this kind of machinery), and is furnished with a roller b^1, at its hind end, which works against the interior surface of the cylinder, for the purpose of causing the ram to move with great steadiness. Two side-rods *c*, extend from a cross-head on the end of the ram to another cross-head *d*, to which the first traction-rod *e*, is fastened. Each traction-rod is of the same length as the stroke of the ram, and the traction-rods are connected together, and to the cross-head *d*, and the carriage that supports the ship, by means of short bolts or pins, inserted into eyes at the ends of the rods. *f*, is a steam cylinder, the piston-rod of which is connected by a rod *g*, with a crank on the shaft *h*; this shaft is provided with a fly-wheel *i*, to regulate its motion; and there are two other cranks upon the shaft, connected by rods with the piston or plunger-rods of two pumps *j*, which are employed for the purpose of injecting water into the cylinder *a*, through the pipe *k*, connected with the opening *l*, (see fig. 2,). *m*, is an air-vessel, which is intended to equalise the action of the pumps.

The mode of drawing ships up the slip by means of the above described apparatus is as follows:—The carriage having been run down the inclined plane or slip, the ship is floated on to it, and properly blocked up and secured; the lowermost traction-rod is attached to the middle or keel-beam of the carriage; and then steam is admitted into the cylinder *f*, for the purpose of commencing the drawing operation. The action of the steam causes the shaft *h*, to revolve and put in motion the pumps *j*, which draw water from an adjacent reservoir and force it into the cylinder *a*, behind the ram, which is then at the beginning of its stroke, with its cross-head close to the upper end of the cylinder. By the injection of the water into the cylinder *a*, the ram is made to move steadily out of the cylinder, and, through the medium of the side-rods *c*, and traction-rods *e*, to draw the carriage, with the ship upon it, up the slip. As soon as the ram has moved out of the cylinder to its full extent, the cock *n*, on the pipe *k*, is closed, either by hand or by a stop upon one of the side-rods *c*, coming in contact with the handle of the cock, which hangs downward; and the continuous supply of water from the pumps *j*, which is thus prevented from entering the cylinder, escapes through a kind of safety-valve *o*. A small cock

p, on the pipe *k,* is then opened, for the purpose of discharging a small quantity of water from the cylinder, and thus permitting the ram to recede until the palls of the carriage bear against the teeth of racks at the sides of the rails, and so take the weight of the carriage and ship from off the side-rods and traction-rods. After this, the first traction-rod, which is connected to the cross-head *d,* is removed; the cock *q,* on a pipe leading from the lower opening *r,* (fig. 2,) of the cylinder *a,* is opened, for the purpose of discharging the water from the cylinder into the reservoir; and the roller or drum *s,* on the shaft *h,* is thrown into gear (by means of a clutch-box), and, by winding up the rope or chain *t,* attached to the cross-head of the ram, it brings back the ram to its first position, ready for a fresh stroke. The drum is now thrown out of gear; the second traction-rod is secured to the cross-head *d*; the cocks *p,* and *q,* are shut; and the cock *n,* being then opened, the pumps inject water into the cylinder *a,* and cause the ram to commence its outward motion. These operations are repeated until the ship has been drawn up the slip to the required distance.

In some cases, the patentee proposes to substitute a piston for the ram, as shewn at fig. 3, which is a longitudinal section of the cylinder *a,* having a piston *b,* within it. The cylinder *a,* is closed at each end; and through the cover of the lower end the piston-rod b^2, works, and is attached to the cross-head *d.* The upward stroke, for drawing the carriage and ship, is effected by injecting water into the cylinder at the back of the piston, through the opening *u*; and the return-stroke is produced by injecting water into the cylinder in front of the piston, through the opening *v.* Or the return-stroke of the piston or ram may be effected by withdrawing or pumping out of the cylinder *a,* the water that has been previously injected into it for producing the forward motion of the ram or piston, in order that the pressure of the atmosphere may act to force back the ram or piston. Or the backward motion of the ram or piston may be produced by the descending force of a reacting weight, which has been previously raised during the forward motion of the ram or piston. If preferred, manual or other power may be employed for working the pumps *i,* in place of steam power.

The patentee, in concluding his specification, states that his invention consists in the application, hereinbefore described, of a hydrostatic cylinder, fitted with a moveable ram or with a moveable piston, and provided with injecting pumps, worked by steam or other power (for forcing water into such

cylinder, so as to move the ram or piston with forcible motion), by way of a motive force for drawing ships up an inclined plane out of water, in the mode commonly known as Morton's patent slip;—the requisite backward or returning motion of such ram or piston being produced, when required, in the manner hereinbefore described, either by a roller winding up a rope or chain, to draw the ram or piston backward; or by injecting or pumping water into such cylinder, to act against the front or uppermost side of the piston and move it backwards; or by withdrawing or pumping out from the cylinder the water that was previously injected into it, for producing the forward motion of the ram or piston, in order that (by so withdrawing water) the pressure of the atmosphere may become operative to produce the backward motion of the ram or piston; or by the descending force of a reacting weight, which was previously raised during the forward motion of the ram or piston.—[*Inrolled December,* 1849.]

To Richard Dugdale, *of Brompton, in the county of Middlesex, engineer, for improvements in hardening articles composed of iron.*—[Sealed 13th January, 1849.]

This invention relates to an improved mode of hardening articles composed of iron; or, in other words, of partially or entirely converting the iron of which they are composed into steel; so that various articles, which are usually made of steel, may now be formed of iron, and, after being fashioned to the right shape, may be hardened or converted into steel, or steeled to any depth;—or, if preferred, they may be hardened in any required part, leaving the rest of the iron in its original state of tenacity, and that without disturbing the surface of the metal, so that manufactured articles will require very little finishing afterwards.

The articles intended to be operated upon are placed in an iron box, and each article is surrounded with a compound of charcoal, borax, sal-ammoniac, and saltpetre, as commonly obtained in commerce. These ingredients are mixed in the pulverized or granulated state, in about the following proportions:—Of charcoal one hundred-weight, borax half a pound, sal-ammoniac a quarter of a pound, and saltpetre a quarter of a pound. For rough and bulky goods, the patentee sometimes employs, in place of saltpetre, about four times the quantity, by weight, of common salt.

In effecting the desired object, by this improved process, the internal surface of the bottom of the box is first covered with the above compound, and upon the bed, so prepared, the iron articles are placed; each article is then completely surrounded with the hardening compound; and the box is closed by a lid or cover, and made as air-tight as possible by means of sand or other suitable material. The loaded box, thus secured, is placed in an open furnace without a chimney, and exposed for several hours to a considerable heat (say, between a red and white heat); the length of time varying from 4 to 24 hours or more, according to the rough or smooth state and size of the articles, and the depth of hardening or steeling required:—the requisite knowledge for properly conducting this part of the process, that is, for regulating the heat and the length of time the articles are to be exposed to the heat, can only be obtained by experience. When the articles have been exposed for a sufficient length of time to the heat, they are to be taken from the box and plunged into water; after which, if the process has been properly managed according to the above instructions, they will be found to be rendered very hard, or converted into steel, partially or entirely: that is to say, they will be hardened or steeled to any certain depth, or quite through, according to the time they have been exposed to the heat, surrounded by the pulverized materials above mentioned.

When the articles are not required to be hardened or steeled in every part, the hardening compound must be placed in contact with those parts only which it is desired to harden or steel;—taking care to cover the other parts with clay or common sand, so as to protect them from the action of the hardening compound.

The patentee remarks, that he does not intend to confine himself exclusively to the above ingredients, as there may be other materials containing the same elements which may produce a similar effect,—and others, not having the same but equivalent elements, which will also produce a similar effect, and may therefore be employed in place of the above or some of the above mentioned,—of which latter the use of salt in place of saltpetre is an instance: the common salt, however, tends to make the steel more harsh and less malleable; but, notwithstanding, will occasionally be found useful when rough and large or bulky articles are to be operated upon. And although other materials than those mentioned may be found to produce a similar effect, some of them will deteriorate the quality of the metal, and others are too expensive for

application. The materials which form the compound above set forth have, however, been proved to possess no deteriorating or injurious tendency; but, on the contrary, they have an ameliorating effect on the metal, and are, at the same time, of moderate cost.

The patentee claims, First,—the use of the above materials or their equivalents, compounded in the manner stated; and, Secondly,—their application, in the manner described, as together constituting an improved process and an economical means of hardening and carbonizing articles made of iron, or the surface of iron, to any depth, whether in rough bars or manufactured articles.—[*Inrolled July,* 1849.]

To William Crofton Moat, *of Upper Berkeley-street, in the county of Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas.*—[Sealed 4th January, 1849.]

This invention consists in improvements in the construction or packing of the pistons and stuffing-boxes of steam, air, or gas-engines.

In Plate III., fig. 1, is a vertical section of the cylinder, piston, and piston-rod of a steam-engine, shewing the improved packing applied thereto. *a,* is the cylinder; *b,* is the piston-rod; *c,* is the central portion and *d,* the outer portion of the upper plate of the piston; *e,* is the lower plate of the piston; and *f,* is a metal ring, which is turned to fit the interior of the cylinder, and forms the periphery of the piston. *g,* is a hollow ring, made of some soft or yielding material, such as lead or vulcanized India-rubber; and it is fitted into a recess in the body of the piston, behind or within the ring *f*: the ring *g,* when uncompressed, is of a circular form in its transverse section; but, when pressed into the recess, it assumes the triangular shape shewn at fig. 1. Down the centre of the piston-rod a passage *h,* is bored, which terminates at the bottom in another passage, at right angles thereto; and this latter passage leads into a small pipe *i,* which is connected by a union-joint with another small pipe that enters into the hollow ring *g.* The top of the passage *h,* is covered by a valve-box *j*; into which is fitted a piece of cork *k,* with a crutch or stool *l,* (shewn detached at fig. 2,); and over the valve-box *j,* a cap *m,* is placed.

The use of the ring *g,* is to keep the ring *f,* pressed against the sides of the cylinder; and this is effected by charging it

at intervals with air at the required pressure. When the ring is to be charged with air, the cap *m*, is removed, and the valve-box *j*, is connected by a coil of pipe with an air-pump; and then air is forced in by the pump until the required pressure is obtained, as indicated by a pressure-gauge. When the ring has been pressed tightly against the cylinder, the pressure should be reduced about one-half, by unscrewing the top of the valve-box until the gauge indicates that the desired degree of reduction has been obtained; and then the top of the valve-box should be screwed down tightly against its seat, the pipe removed, and the cap *m*, put on to prevent any air escaping past the valve.

Instead of the air being forced into the ring *g*, through a passage bored in the piston-rod, it may be introduced by means of a pipe passed down through the cylinder, at the side of the piston-rod, into the body of the piston; or the air may be injected directly into the piston, by introducing a hand condensing syringe through an opening in the cover of the cylinder, and inserting the nozzle of it into an opening in the body of the piston, which communicates with the interior of the ring *g*. Fig. 3, is a vertical section of a cylinder and piston, suitably constructed for the adoption of either of these methods of introducing air;—in the cover of the cylinder there is an opening for the introduction of the pipe or syringe, which is closed by a door or stopper *n*; and in the top plate of the piston there is an opening at *o*, which, if the hand-syringe is to be used, must be covered by a valve.

In place of a constant command being maintained by the aforesaid means over the pressure of the air (so that it may be supplied only when wanted, and to the exact amount required), the ring *g*, may be charged in the first instance with air compressed to such an extent above the average pressure required as to obviate any necessity for renewal; in which case the air-passages, air-pump, and their appendages, would be dispensed with; but as the engineer would not then possess any ready means of ascertaining the soundness of the piston, or of repairing it in the event of damage from violence, this mode of packing is not considered so good as that above described. These objections do not however apply to packing the stuffing-boxes of cylinder-covers in this manner; and the patentee recommends that stuffing-boxes should be packed with air-tight hollow rings, of some yielding substance, charged at once with air compressed to the required degree. In some cases the hollow yielding ring *g*, charged with air, may be dropped loosely into a recess between the upper and under

plates of the piston, and close to their respective peripheries; and then the plates are to be drawn together, by means of screw-bolts (as at *p*, *p*, fig. 3,), until the ring *g*, is compressed into a much smaller space than it originally occupied, and the air within it is proportionably compressed. Fig. 4, is a vertical section of a stuffing-box packed in the manner just described. It is not necessary that the hollow yielding ring should be of a circular form; as it may be made in the form of semicircles or other portions of a circle.

The patentee states that, instead of using hollow yielding rings in a horizontal position for packing pistons and stuffing-boxes, he sometimes effects the same object by the employment of short lengths of tubing, of lead or other yielding material, applied in a helical direction, as shewn in the stuffing-box *q*, fig. 3. The pipe is first tapered off and closed at the two ends, as shewn at fig. 5; after this, it is coiled around the piston-rod with the bottom end resting on the lower part of the stuffing-box; and then the upper plate is screwed down upon the pipe, until it is not only pressed out at both sides, but is altogether compressed into a much narrower space than it originally occupied, and the air within it is compressed to a corresponding extent.

The patentee claims the employment of yielding hollow rings and yielding tubing, of whatever material the same may be composed, filled with air, more or less compressed, for the packing of the pistons and stuffing-boxes of engines worked by steam, air, or gas, as above described.—[*Inrolled July,* 1849.]

To JOSIAH BOWDEN, *of Liskeard, linen-draper, and* WILLIAM LONGMAID, *of Beaumont-square, in the county of Middlesex, Gent., for improvements in the manufacture of soap.*—[Sealed 4th July, 1849.]

THIS invention consists in improvements in manufacturing soft soap from rosin and tallow.

In the manufacture of such soap, it has been the practice first to make hard soap and then to convert it into soft soap; but, by this invention, the raw materials (viz., rosin and tallow) are converted directly into soft soap. The patentees first make an alkaline lye of about the strength of 5° Twaddle's hydrometer; and, for this purpose, they prefer to use soda-ash, containing 80 per cent. of carbonate of soda. To twenty gallons of caustic lye about twelve pounds of tallow and eight

pounds of rosin are added (the quantity of solid matter may, however, be varied according to circumstances); and when the tallow and rosin are dissolved, the mass is allowed to boil for twenty or thirty minutes. The operation is then complete, and the soap may be ladled into suitable vessels. Or, to a lye of the strength of 4° Twaddle's hydrometer, the patentees add sufficient caustic potass to increase the strength thereof to 5°; and then they employ it for making soap in the manner above described. In this case also the relative proportions of the materials may be varied, so long as the peculiar character of the process be retained.—[*Inrolled January,* 1850.]

To John Thomas Forster, *of Plymouth, a master in Her Majesty's Navy, for improvements in the building of ships, boats, and other vessels; also in the manufacture of boxes, packing-cases, roofs, and other structures requiring to be waterproof.**—[Sealed 27th June, 1849.]

This invention consists in the employment of planks and boards of wood, coated with gutta-percha or gutta-percha combined with other matters, as planking and sheathing, and also as linings or ceilings of ships, boats, and similar vessels.

The patentee first causes the planks or boards to be coated with gutta-percha or gutta-percha combined with other matters; and this he prefers to effect in the following manner:—The wood should be dry, and should be left rough on all its surfaces, as it comes from the saw. It is first coated with waterproof cement (by preference, dissolved India-rubber or dissolved gutta-percha); and when this has become comparatively dry, sheets of gutta-percha are applied thereto, with pressure,—the several surfaces of the wood being veneered, as it may be termed, with gutta-percha. The surface of the gutta-percha, which is applied to the wood, is warmed, so as to cause it to adhere more readily; and for warming the under surface of the sheet of gutta-percha, the flame of gas may be employed, or a blast of heated air, or any other suitable means.

In some cases, particularly for the thin planking to be used in building small boats, the patentee prefers to cement two

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* By a disclaimer, dated December 27, 1849, the patentee has erased the words "also in the manufacture of boxes, packing-cases, roofs, and other structures requiring to be waterproof" from the title of his patent, which now reads thus,—"improvements in the building of ships, boats, and other vessels."

or more thicknesses of thin planking or boards together with a waterproof cement, and then to coat the outer surfaces with gutta-percha or gutta-percha combined with other matters: by this means the planking of a boat will be rendered less liable to split when out of the water and in dry places.

The planks or boards, coated as above described, are to be used as planking or sheathing for the outsides of ships generally, and also for internal linings or ceilings thereof; and such is the case with respect to steam and other large boats and similar vessels. In applying such coated wood, the edges or ends which overlap or which butt against each other should have a coating of waterproof cement (dissolved gutta-percha is preferred) applied thereto, and over the surfaces of the joints, in order to cause them to adhere and be waterproof; and when wooden trenails or fastenings are to be driven through such planks or boards, they should be first dipped into a waterproof cement. Planks or boards, coated with gutta-percha or gutta-percha combined with other matters, may also be used for forming water-tight bulkheads of ships, boats, and other similar vessels.

The patentee says he is aware that it has been before proposed to employ gutta-percha and gutta-percha combined with other matters (but not combined with wood) as a sheathing for ships, boats, and other vessels; he does not therefore claim the same; but he claims the application of planks and boards of wood, coated with gutta-percha or gutta-percha combined with other matters, in the building of ships, boats, and other similar vessels, as above described.—[*Inrolled December,* 1849.]

To THOMAS COCKSEY, *of Little Bolton, in the county of Lancaster, millwright, and* JAMES NIGHTINGALE, *of Breightmet, in the said county, bleacher, for certain machinery to facilitate the washing and cleansing of cotton and other fabrics; which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizing warps and piece-goods.*—[Sealed 16th April, 1849.]

THIS invention consists in an improved arrangement of machinery, principally intended for washing cotton and other fabrics; but which machinery may also be used in the various processes mentioned in the title.

The machinery is composed principally of a series of revolving beaters, which rotate in a trough containing water, in such manner that the fabric to be washed descends from each

beater into the water, and ascends therefrom to the next beater; and in the spaces between the beaters are placed angular carriers, which have no other motion communicated to them than that caused by the passing of the fabric through the machinery, and which serve to move the fabric to and fro in the water. The beaters are each formed with four angles, in order that they may beat the fabric four times in a revolution; but the number of the angles or beating surfaces may be varied; and although the spaces between the four angles are represented in the drawing (hereafter described) to be closed, this is not essential. The supply and discharge of the water used for washing the fabric is so arranged that the fabric may leave the water at the part of the machine where the supply takes place; and therefore the fabric, when about to leave the trough, is subjected to the action of cleaner water. In order that fabrics of different strengths may be washed by this machinery, the beaters are driven by means of friction clutches, which will admit of the speed of the beaters being reduced when weaker fabrics are passed through the machine.

In Plate III., fig. 1, is a side elevation, and fig. 2, a longitudinal section of the washing machine. *a,* is the trough, into which water is constantly entering through the pipe *b,* and from which the water is constantly flowing through the pipe *c.* *d, e, f, g,* are the beaters, which are caused to rotate by means of bevil-wheels *h,* fixed on their axles, and gearing into other bevil-wheels *i,* on the shaft *j.* This shaft *j,* receives motion through the bevil-pinion *k,* on the end thereof, in gear with a wheel *l,* fixed on the axis of one of the pressing-rollers *m,* which is driven by a steam-engine or other first mover. The bevil-wheels *i,* are not fixed on the shaft *j,* but are connected therewith by clutch-boxes, each consisting of friction-straps, embracing a boss on the wheel; so that when the straps are tightly screwed up, the wheels will be firmly connected with the shaft; but when they are less tightly screwed up, a certain amount of slipping will take place: the patentees do not confine themselves to this arrangement, so long as friction clutch-boxes are employed. The arrangement adopted by the patentees is such, that when the bevil-wheels *i,* are fixed to the shaft *j,* the beaters are caused to rotate with three times the speed at which the fabric is travelling through the machine (which will be sufficient for the strongest fabrics); and such speed of the beaters will be reduced when the degree of friction between the parts of the clutch-boxes is reduced. *n,* is a weighted lever, which is employed for pressing the rollers *m,* together, and is for this purpose connected by a rod *o,* with

the lever *p,* which is mounted above the bearing of the upper roller *m.* *r, s, t, u,* indicate the angular carriers.

The fabric to be washed enters the trough *a,* at that end where the pipe *c,* is fixed, and, after passing beneath the first of a series of small rollers *v,* it ascends and passes over the first carrier *r*; it then descends beneath the second roller *v,* from which it ascends and passes over the first beater *d*; from this beater the fabric descends beneath the third roller *v,* and then ascends to the second carrier *s*; and in this manner it proceeds through the machine until it arrives at the pressing-rollers *m,* between which it passes, and then it is carried away upon the reels *q.* The fabric, as it proceeds through the machine, in addition to passing into and out of the water, is caused to move to and fro in the water by the carriers *r, s, t, u.*

The above machinery may also be employed in such parts of the process of bleaching, dyeing, printing, and sizing fabrics and warps as require the fabrics to be passed through liquid: in these instances the proper liquids will be substituted for the water in the trough *a*; and there will be no necessity for a continual overflow.

The patentees claim the combining of several beaters in such manner that the fabrics descend into and ascend out from the water between the succeeding beaters; also the combining a series of angular carriers moved by the fabric,—the fabric descending into and ascending from the water between the succeeding carriers; likewise the employment of a long trough in combination with a succession of beaters and a succession of carriers, in such manner that the fabric may leave at the end where the water enters, as above described; and also the employment of friction clutch-boxes in combination with a series of beaters, as above described.—[*Inrolled October,* 1849.]

Scientific Notices.

ON THE PROPOSED EXHIBITION OF THE PRODUCTS OF INDUSTRY OF ALL NATIONS.

The long-talked-of scheme for exhibiting the combined results of the industry of mankind must now be considered as fairly launched before the public, and that too with every prospect of success, if the prestige of great names and Royal favor is to be esteemed of its wonted value. It is seldom that any project has so well recommended itself to public notice as that for gathering, under one roof, in the great central emporium

of commerce, specimens of the productions in which the several nations constituting the civilized world specially excel; we are sorry, therefore, that a false step should have been taken at the outset, calculated to damp the ardour, or risk the loss of the cordial co-operation of any, even the least important, class which might aid in displaying, in their full splendour, the industrial resources of Great Britain; but we trust that, as the arrangement for farming out the anticipated profits of the exhibition has been abandoned, on the remonstrance of a large body of influential merchants and manufacturers of the north (without whose active support the project must necessarily have fallen to the ground), there will now arise nothing further to disturb the harmonious feeling with which the first announcement of the intended exhibition was greeted. That the pecuniary assistance of government should, from the outset, have been eschewed, it is easy enough to understand; for such aid would have entailed the constitution of a commission, endowed with the usual powers to ride rough-shod over the wishes and expectations of the community; whereas, by making the pecuniary contributions voluntary, the governing power would virtually rest in the subscribers,—whatever parties might represent their delegated authority. But it augurs, we think, no slight ignorance of public feeling on the part of the foremost promoters of the undertaking, to have entered into a treaty with a trading firm to furnish, at their own risk, the sums of money required for erecting suitable buildings for the exhibition, and for prizes to successful competitors. This step appears indeed to be altogether without precedent; and if it had not been retraced, would have formed a reasonable pretext for speculating capitalists, at a future time, to propose to government to contract for the carrying on of a war, on condition of sharing in the plunder; or, indeed, to take up, on speculation, the prosecution of any other purely national affair.

We have said that the scheme for exhibiting the industrial products of all nations is now prominently before the public; this is, however, but small progress towards the successful completion of the contemplated design. A commission has also been appointed and secretaries nominated by Royal proclamation; but little has been said in relation to the *object* which the exhibition is intended to effect, and less of the *means* whereby that object is intended to be carried out. As, however, our connection with the manufacturing world would seem to demand from us something more than a passing notice of this vast project, the purport of this paper will be, to call attention to these two points (the object and the means), on

which, in fact, the whole success of the undertaking hangs; for it is comparatively easy to draw together a vast variety of natural products, manufactured goods, and ingeniously-constructed machines, from all quarters of the globe, by offering money prizes to a large amount; but to apportion the funds received for the specific object of rewarding the most deserving exhibitors, so as to prevent the expression of just indignation from disappointed competitors, necessitates the adoption, at starting, of a clearly defined principle, which shall guide the commissioners in all their proceedings. It is almost superfluous to say that no such principle has yet been put forth; we are inclined, however, to think that, from the connection of a small but busy clique of the Society of Arts with the project, *utility* will be pooh-poohed, and that mere *decoration* will carry the palm: if so, manufacturers should be made aware of the fact, as much needless exertion would be thereby saved, and much heart-burning and jealousy avoided. If we were to ask—what is to be gained from this projected exhibition? we should quickly receive as an answer—the general encouragement of manufacturing industry: but of late years the ingenuity of man, under the pressure of competition, and the increasing desire to get wealth, has been driven to such shifts, that we are not quite sure that industry, as applied to manufacturers, should be taken for granted as, in the mass, really deserving of encouragement: it behoves us therefore to keep in mind the original design of human labor, while we consider what branches of manufactures are deserving of the special favor which is now to be offered, through the commissioners, to industry, and what kind of improvements in those branches is most worthy of reward. Now it will not be denied that the main-spring of all human labor is the desire to increase our comforts by diminishing our mental and physical wants or cravings; for where that feeling is but feebly developed, as in the Hottentot and other savage tribes, industry is almost unknown. Of these wants the *physical* demand the first attention; and hunger being the most prominent of this class, agriculture has always received, in every country (California excepted), the chief attention of the inhabitants. Protection from the inclemency of the weather, being second in importance, was next sought, through the erection of buildings and the adoption of clothing suitable for withstanding the variety of climates and seasons to which the different races of the world are exposed; and, lastly, various utensils were devised, to facilitate the preparation of food, and the performance of other domestic operations. To satisfy then the primitive wants of

mankind, food, shelter, and domestic utensils, were found necessary; and, as at the present day the scanty supply of these essentials is as keenly felt as it was at any former period of the world's history, it would seem to follow that the most desirable appropriation of the prizes, which are to be distributed for the encouragement of skill and ingenuity, would be, to those fields of industry, in the fruits of which all classes alike participate; and to that kind of improvements which will render the production of those fruits less costly, and thereby place them within easier reach of the poor. Under this view of the matter, we should have "Agriculture," "Building," "Clothing," and "Domestic Utensils," taking the first rank; and the improvements under these several heads would be open to receive the highest prizes which are to be awarded. For the purpose of systematizing the exhibition, it would be well to preserve the natural divisions already existing in manufacturing industry; not those indicated by the different sciences on which the several branches are based—as chemistry, mechanics, &c.,—nor by the species of skill which they call into requisition; but according to the ultimate object which the applied product of industry is designed to effect. These natural divisions should be numbered in classes; and each class, when requisite, should have its sub-divisions,—whereby competing manufactures of similar character would be brought into juxtaposition; and the meed of praise (or reward) would be determined—first, according to the prominence of the class under which any given manufacture was placed; and, secondly, according to the degree of superiority which it possessed over similar manufactures in its sub-division. It should also be clearly made known that machinery or apparatus, as the means of producing, would in every case take precedence of the article produced; for otherwise there would be no warranty that economy was considered in the manufacture; and two articles might be brought into competition, the one produced by machinery, and the other by manual dexterity; which latter quality, however useful it may have been, is contemptible so soon as it attempts to compete with the evolutions of inanimate matter.

According to this plan, then, there would stand "Agriculture," as Class I., which would embrace every variety of agricultural implements,—also manures, drain-tiles, and machines for making the same, model plans of homesteads, and, in fact, any tangible matter or composition of matter calculated to facilitate the growth of agricultural produce at a reduced cost (if not specially included in another class). The sub-divisions

under this class would be obvious; and the advantages to be derived therefrom would be equally clear; for no man, or set of men, could determine the relative superiority between the best plough and the best manure, as compared respectively with those now in use, so as to satisfactorily award the highest prize offered for agriculture to the more ingenious and deserving of two competitors pursuing such different callings: but where the value of the two things to the community is considered, there can be no doubt as to which should take precedence,—the manure being capable not merely of a wider application in agriculture than the plough, but also producing for the outlay a much greater result; as the only advantage effected by the improvement in the plough would be, perhaps, a slight decrease in the draught, or a better means of applying the power. At the outset, therefore, of this great national undertaking, we think it would be wise first to allot the money which is destined to be distributed as prizes, in specific sums, to certain general heads or divisions of industry; and, under those heads, to determine the order of importance of the several sub-divisions, according to the economic advantages which they severally are calculated to confer on the division of industry to which they belong,—the relative value of that division, as compared with others, being first determined on the principle above enunciated.

As a carrying out of our plan for encouraging ingenuity to pursue those paths best calculated to alleviate the primary wants of mankind, in preference to ministering to artificial requirements, we should—keeping in mind the universal demand for shelter and protection from the vicissitudes of the seasons—take the general term "Building" for Class II.; but as buildings must necessarily, from their nature, be excluded from the exhibition, we should propose, under this class, to include all improvements calculated to render the erection of dwellings, warehouses, &c., less costly, and ensure their durability. Thus, under this head, there would be found all machines relating to brick and tile-making—to splitting slate—dressing and polishing stone—sawing and planing timber—splitting laths—casting, grinding, and polishing glass—all machinery and apparatus for facilitating the manufacture of cast and wrought-iron girders, pipes, gutters, and pillars—and also apparatus for heating and ventilating.

To designate Class III., we should adopt the word "Clothing,"—using it, however, in a limited sense, with the object of giving a greater prominence to necessities than to conveniences or luxuries. Under this head we should include all

machinery or apparatus calculated to improve the manufacture of cotton, linen, and woollen piece-goods—such as calicoes and linens, in their unbleached state—flannels—and woven and felted cloths—also felted articles in form for use—hosiery goods—and leather. There would thus be embraced, under this class, burring, carding, combing, drawing, roving, spinning, and weaving machinery for cotton and wool—retting apparatus, breakers, scutchers, heckling, and gill machinery, specially for flax—also felting machinery of various kinds—knitting frames and warp knitting machines, and all apparatus for facilitating the curing of skins.

From the vast changes which have taken place in society consequent on the division of labor, some utensils which were formerly to be found in every household—as, for example, the corn-mill in its primitive form—have ceased to be used in private families; and others which are now employed in the preparation of food, form substitutes for tedious manual operations;—we should therefore, for Class IV., adopt as a heading, "Victualling and Domestic Utensils;" under which would be appropriately arranged all improvements in machinery for cleansing grain from smut, grinding corn, and dressing flour—apparatus for hulling rice—for bread and biscuit making—improved ovens for baking bread—apparatus for crushing the sugar-cane, rectifying and boiling the syrup, and clarifying sugar—for malting, brewing, and distilling—and for roasting coffee, &c.—all machinery or implements connected with the throwing, turning, moulding, drying, firing, and glazing of earthenware—all apparatus or tools connected with the manufacture of glass vessels—machinery connected with the forging, grinding, and polishing of cutlery—also articles of cutlery and hardware of new constructions—rolling and stamping machinery, for the production of candlesticks, lamps, trays, pots, kettles, and other like useful domestic articles—and likewise machinery for sawing wood into irregular shapes, and dovetailing, for the purpose of manufacturing chairs, tables, &c. The sub-divisions under this class would of necessity be very numerous; and their degree of importance would considerably vary; but, under judicious management, the relative merits of the several machines, apparatus, tools, and utensils, could be ascertained with comparative facility. Here also we should propose to arrange the articles, not according to the branch of manufactures to which each belonged (as, in some instances, they will be found to refer, not strictly to one, but many branches), but to the object they were designed to effect. Thus, for instance, all apparatus, whether made of metal, glass,

or earthenware, when intended to prepare decoctions of coffee, &c., would appropriately come under the same sub-division; and, with equal propriety, should baths (whether made of metal or earthenware), candlesticks, and other articles which are susceptible of being constructed of different materials, have a separate division allotted to them.

Thus far, then, have we followed the divisions in manufacturing industry, which are suggested by the primary wants of man, and which are, as we think, eminently calculated to simplify the otherwise herculean task of determining justly the relative merits of works varying so much in character as those we are to expect at the great exhibition of 1851. There is, however, one class of industrial products which, although in the earlier stages of society the extent of its useful applications was little dreamed of, has now become to us of the utmost importance, inasmuch as every manufacture, in the present advanced state of the useful arts, is dependent on it for success: we need scarcely remark, that our allusion is to the metals. Iron, in particular, has been the great friend of man, for by its aid he has literally been enabled to subdue the earth, and ride fearlessly over the seas; nor have the other metals done mean service: we should, therefore, feel justified in placing the manufacture of the metals on an equality of rank with agriculture, as respects this exhibition; for no improvement can be effected in the former without conferring a direct benefit on agriculture, as well as upon all other branches of productive industry. But as the manufacture of metals is dependent on an abundant supply of fuel, which, to be obtained, involves the use of precisely similar means to those employed in obtaining metallic ores, we should apply to Class V. the general term "Mining and Metallurgy." This class would, therefore, embrace all improvements in apparatus connected with mining for the obtaining of coal and crude metallic ores; and also for treating the ores to extract the pure metals therefrom. These improvements would require to be shewn by models; but, in that form, there would be admissible to the exhibition—lifting and other machinery for mines—machinery for stamping, sorting, and washing metallic ores—smelting furnaces—rolling mills, &c.—and all apparatus calculated to render the several stages of the manufacture less dangerous to the life and health of the workman; unless, indeed, a separate class were formed for the reception of all ameliorative contrivances with reference to health.

Under a distinct head, say Class VI., all motive power-engines should be arranged,—these being also admissible as

models; but, with all such as were designed to compete for prizes, the certificate of a party recognized by the commissioners should be sent in, setting forth the actual performances of the engines which the models represented: in cases where compactness of arrangement or such other visible object is sought, the certificate would of course be unnecessary.

In following out this system we should go through the whole range of productive industry, assigning to each class its superiority of position, according to its bearing on the wants of mankind, and apportioning to each a suitable share of the whole amount of prize money, and honorary rewards to be distributed. Having taken into consideration all those branches of manufactures which contribute directly or indirectly to the supply of food, simply as food—to the erection of buildings, exclusive of decoration—the production of necessary clothing—and land and water transit, we should next turn to those manufactures which specially minister to man's intellectual wants; such, for instance, as type casting, paper making, printing machinery, &c.;—forming them into classes, and subdividing each class as before, for the purpose of effecting a healthy rivalry in every trade, and enabling the judges to determine the merits of the several competing plans exhibited. By this means no useful product of industry would be overlooked, but each would have a predetermined status, which would form a check to the lavish expenditure frequently indulged in by manufacturers for the production of goods of an unimportant character.

From the purport of the foregoing remarks, which give but a hasty and very imperfect sketch of our manufactures, it may be not unfairly assumed that our views are wholly utilitarian;—to this impeachment we must certainly plead guilty; but the doctrines of our creed do not exclude the employment of decoration and purity of form in articles of common use, as a means of leading the mind to an appreciation of the fine arts; nor are we insensible of the commercial advantages which decorative art confers upon manufactures:—we would not, therefore, have it supposed that we have passed over ornamental design with intentional neglect; for, on the contrary, we consider it well deserving of encouragement (although subservient to those divisions of industry already treated of); we hope, however, at another opportunity, if we are not, in the meanwhile, anticipated by an abler hand, to offer a few observations on the connection of the fine arts with manufactures.

ON THE SUBSTITUTION OF PREPARATIONS OF ZINC FOR CARBONATE OR CHROMATE OF LEAD AS PIGMENTS.

THE compound commonly known as white-lead (chemically speaking, the carbonate of oxide of lead) is universally employed, not only as a pure white pigment, but also as the basis of almost every color of light tint when covering power and great body of coloring matter are necessary. In some respects, carbonate of lead possesses properties which render it more extensively useful to painters than any other substance known to the chemist. In the first place, when ground with either oil or water, it forms a mixture of extraordinary density and opacity; which, when laid upon a surface of metal or wood, endues that surface with a coating of matter completely impervious to light; so that the rays of the latter falling upon such a surface, are scarcely at all absorbed, but nearly all reflected back to the eye: the painted surface consequently appears of a strong opaque white, and the original color of the object, whether it be natural or arise from a previous coating of paint, is perfectly covered and hidden. The great opacity of carbonate of lead gives to it as a pigment the property technically termed its "covering power," a property which does not exist to an equal degree in any substance hitherto proposed as a substitute for it. Carbonate of lead is also perfectly neutral; it therefore exercises no action upon other pigments, neither changing their color nor otherwise affecting them; and from its physical character or texture, it is easily ground with water or oil,—blending completely with them, and forming a smooth homogeneous mixture, which can be laid on by the brush with great facility. These are points in which white lead must be considered superior to any compound that has been employed in its stead; but it possesses a great defect, which is sufficient to render it highly desirable that some substance may be discovered which may be substituted for it in the arts. Certain metallic oxides or compounds have accordingly been, for some time past, proposed as a substitute for white lead; but among them, the oxide of zinc alone seems entitled to attention. In order, however, to understand the comparative value of these proposed substitutes, *quo ad* their chemical qualities, it will be necessary to examine into the habitudes of lead itself. Carbonate of lead is a compound upon which the normal constituents of the atmosphere are incapable of exercising any chemical influence; but it seldom happens that near the dwellings of man, at least in crowded

cities, the atmosphere is found in its normal state of purity. The emanations from the bodies of living animals, and the exhalations from decaying animal and vegetable matter, serve to contaminate the air with a multitude of gaseous matters foreign to it in its natural condition; among these is found a gaseous compound of sulphur termed sulphuretted hydrogen. One of the striking properties of lead, in any state, is its affinity for, or tendency to combine with, sulphur. It is impossible for lead and sulphur to be brought into contact without this combination taking place. So predominant and searching, indeed, is this force, that even if a piece of paper be wetted with a solution of sugar of lead (acetate of lead) and placed between the leaves of a thick book, sulphuretted hydrogen will, if it exist in the air, find its way to the lead on the surface of the paper and there combine with it, forming a black compound, which chemists call the sulphuret of lead. Every compound of lead is subject to this action, no matter whether it be soluble in water or otherwise; the sulphur will seize upon the lead, and the black sulphuret will be formed. This is the secret of the blackening of white paint in certain localities in which sulphuretted compounds are freely evolved; and this change takes place more or less rapidly under all circumstances, for there is always sufficient sulphuretted hydrogen in the air to ultimately effect the formation of the sulphuret of lead. It may be said that, practically, this property of lead to combine with sulphur, and blacken under its influence, amounts to no great defect,—that the lead is so completely enveloped and protected by the oil and varnish, that the action of the sulphuretted hydrogen is set at defiance. Such, however, is not the fact; and this may be easily proved by examining a surface of white paint in the neighbourhood of a drain or cesspool, where it will be found covered with a blackish-grey semi-metallic-looking film of sulphuret of lead. Chemically, then, we see at once the reason why white lead can never be regarded as a permanent color; this remark applies as well to the colored preparations of lead as to white lead; and it is an indisputable reason why, in all cases where permanence of color is a chief object, some metallic compound should be employed, in which sulphuretted hydrogen can produce no change, or, at all events, no blackening. There are but few substances, perhaps one only, which fulfil the necessary conditions; the one we refer to is zinc As a white pigment, more than one substitute for white-lead has been proposed, such as oxide of antimony and sulphate of baryta; these, however, from their want of that remarkable opacity so peculiar to white-lead, seem to be of but

little value. The oxide of zinc alone keeps the field. Oxide of zinc, although not possessing the "covering power" of white-lead, has still sufficient opacity to admit of its being substituted for the latter with great advantage: It works as well with the brush, grinds with facility,—forming a perfectly smooth mixture with oil, and, like white-lead, is a neutral substance, inert, in relation to other coloring compounds. With respect to its chemical habitudes, oxide of zinc is far superior to carbonate of lead, and why? Simply because, in the first place, the affinity of zinc for sulphur is much less than that of lead for the same substance; and, secondly, because the sulphuret of zinc is as white as the oxide: so that if, by any means, the whole of the oxide of zinc, laid upon an object as a white pigment, became converted into sulphuret, the whiteness would remain unsullied, for the oxide would merely have passed into another compound as white as itself. Oxide of zinc may, therefore, be regarded as a truly permanent color; and is invaluable, under circumstances where the blackening of the lead compounds would prove a serious disaster.*

The chromate of zinc, a beautiful yellow substance, is another most valuable pigment, which may be well substituted for chrome-yellow in all cases.

It is, however, chiefly with regard to the labors of the artist that these considerations are of value. The blackening of a surface of white paint can, under ordinary circumstances, be easily remedied; but such a change in a picture would be irremediable: how much, therefore, does it behove the artist to study the chemistry of his colors before he commits himself to their employment.

T. W. K.

ON THE APPLICATION OF CARBONATE OF LIME, IN PREFERENCE TO QUICK-LIME, FOR THE AMELIORATION OF SOILS.

BY M. N.BOULÉE.

In 1846, after the completion of the great baths at Chalets, St. Nérée, (Hautes Pyrénées), I remarked, says M. Boulée, that the workmen had covered their yard, in which the stone was hewn, with a thick coating of the debris of the stone employed in the building, (a kind of marble analogous to that called by the Italians "white veined.") I felt persuaded that, in spite of its hardness,

* The value of oxide of zinc as a pigment has been long known, but it could not be procured in sufficient quantities for any practical purpose. At the present time, however, this difficulty is removed: within a few years several patents have been taken out for the preparation of this substance, which is now becoming an article of commerce.

this marble, reduced to a kind of sandy state, would produce, in granitic soils, the same effect as if it had been previously converted into quick-lime. I therefore had a quantity of the detritus or stone cuttings sifted, and obtained about a cubic metre of coarse calcareous powder. I applied this, in narrow definite bands, to a soil entirely composed of disintegrated granite. In the first crop afterwards obtained from this land, very little effect was observable. About two months after the harvest, I had, however, again an opportunity of examining the state of the land, and I saw with great satisfaction that there was a much larger quantity of vagrant plants growing in the stubble, where the carbonate of lime was present, than in other places: above all, I remarked certain plants which particularly affect calcareous soils, and others which are never found in soils entirely destitute of carbonate of lime. I observed, also, that the stubble itself was thicker and stronger in the bands that had received the application of the marble cuttings; indeed, the result of observations continued at the spot, convinced me that the ears of wheat and barley were much larger, and the straw thicker, where the soil had been amended by the addition of the calcareous matter.

I believe that, from its insoluble character, this calcareous debris would continue to exercise a beneficial influence on the soil during thirty or forty years, or even more,—as, from the size and hardness of the particles, it would require a long period for the air and moisture to effect their complete disintegration. If the fragments of marble were reduced to fine powder, before being applied, the effect would be much more rapid and sensible, but at the same time it would be less lasting.

In converting carbonate of lime into quick-lime, it is brought into a state of extreme division, and rendered soluble, but its action is much less durable, and it is generally exhausted by the end of four or five years.

It may easily be perceived that, in the experiment I have described, the effects would be much more apparent in the third or fourth than in the first year. In order that it may act upon vegetation, the calcareous matter must be rendered soluble; and the solution should be left sufficiently long in contact with the roots of the plant for it to be absorbed. Now, whilst it remains on the surface, the substance is subjected to the action of moisture only during the time that rain is falling, or, at all events, only so long as the earth remains wet. As soon as the latter becomes dry, the calcareous detritus is inert towards the plant.

The case is, however, different, when the detritus is buried in the ground, occupying the region in which the roots of plants seek their nourishment;—the soil preserves during all times more or less humidity, and the calcareous substance is consequently always under this influence.

What I wish, however, to inculcate, as the result of my experi-

ment is, that carbonate of lime may be employed, under many circumstances, with advantage, without previously converting it into quick-lime. As to the question of knowing where it is best to employ carbonate of lime, and where quick-lime, that is a matter of some difficulty. To arrive at its solution, we must take into account the nature of the mineral constituents of the soil, the cost of bringing to it manures natural or artificial, the hardness of the carbonate, the means required to reduce it to powder, more or less fine, its greater or less degree of solubility, under peculiar circumstances, the cost and comparative facility of calcining, and the cost of liming in the ordinary way.—[*Comptes Rendus.*]

ON THE PRESENCE OF SILVER IN METALLIC MINERALS, AND THE MEANS TO BE EMPLOYED FOR ITS EXTRACTION.

In a memoir presented to the Academy of Sciences at Paris in July, 1847, by MM. Malaguti and Durocher, it was shewn that silver was found in combination with many metallic sulphurets in which it was not previously supposed to exist. These gentlemen have now further extended their experiments, from which it appears that silver is found in most metallic minerals, even when they are not obtained from silver veins. As a confirmation of this, it appears that out of upwards of two hundred different substances examined there was only one in twenty which did not yield silver. In some of these substances, it is true, only slight traces of silver were found; while in others it required great skill in the mode of testing to determine its presence with certainty.

In experiments made by MM. Malaguti and Durocher upon the roasting of several kinds of sulphurets, they were somewhat surprised to observe that one half the quantity of silver contained in blend ores was liable to be lost by sublimation. Under certain circumstances, therefore, this metal is volatilized with much greater facility than was supposed: it will be found incrusted on the sides of the apparatus.

This is also the case with the silver sublimed in the roasting of galena ores; and the explanation of an important fact in metallurgy is thereby furnished, namely, that notwithstanding the precaution taken to collect the pulverulent cadmium from the chamber of condensation, there is always considerable loss in the silver carried off, which clings to the inside of the pipes, but so as to be capable of being separated therefrom.

Silver appears also to be unequally distributed throughout the various metallic compounds; thus oxides and saline compounds are always less rich in it than sulphurets; and amongst these latter, compounds of iron are generally less rich in silver than those of lead, copper, and zinc. These remarks, touching the unequal distribution of silver in substances found in nature, seem,

moreover, to be confirmed by what takes place in operating by the dry method, whether performed in the laboratory or in metallurgical works.

The universal diffusion of silver throughout the mineral world would lead to the belief that other metals are likewise diffused amongst various substances in nature: in fact, this has already been found to be the case with regard to iron. This led to the examination of crystallized minerals, apparently in a state of purity. Twelve samples of galena were experimented upon, and in all of them, besides silver, considerable quantities of iron, copper, and zinc were found.

In order to ascertain the state in which silver is combined, in small quantity, with various metallic minerals, and especially sulphurets, sulpho-arseniurets, and sulpho-antimoniurets, various re-agents were employed, which were supposed capable of acting upon metallic silver, and not upon its sulphuret,—especially when this latter is in combination with sulphurets of other metals. The employment of liquid chlorine, bichloride of copper, and persulphate of iron, did not furnish any very positive results; more certain indications were produced by means of mercury; but out of thirty-eight specimens which were experimented upon, several of which were very rich in silver, only eleven gave up a portion of their precious metal to the mercury. A comparison with the results of experiments made under similar conditions, upon substances in which metallic or sulphuretted silver had been introduced, led to the conclusion that, in all probability, silver does not exist in the same form in all sulphurets containing small quantities of that metal; but that it is often combined in the state of sulphuret with the substance accompanying it. Besides, it appeared from former experiments, that metallic sulphurets could not contain silver in the state of chloride or bromide; and it was moreover observed, that remarkable reactions took place between chlorides and sulphurets. These latter may be divided into three kinds: 1st, bimolecular sulphurets, such as those of zinc, cadmium, lead, &c.; 2nd, sulphurets containing several molecules of sulphur, and susceptible of giving up a portion of it—bisulphuret of tin, for example; 3rd, sulphurets not saturated with sulphur, and ready to take up a greater quantity, such as protosulphuret of copper. The first kind of sulphurets reacts upon chloride of silver by double decomposition; the second undergoes partial reduction, and is converted thereby into protosulphuret; and the third partially reduces chloride of silver, upon which it also acts by double decomposition. The arseniurets, sulpho-arseniurets, and sulpho-antimoniurets, under the same circumstances, act upon chloride of silver in the same manner as the sulphurets.

These different bodies were introduced into the presence of the chloride of silver, dissolved sometimes in ammonia, and sometimes in hyposulphate of soda; but the presence of the solvent produced no other effect than that of accelerating the phenomenon

and facilitating its observation, without, however, changing its essential conditions.

It is curious to observe, that the decomposition produced by sulphurets, arseniurets, &c., is often as clear and complete as if bodies dissolved in water were operated upon. The following bodies may be given as instances of this, viz., native sulphuret of copper, arseniuret of antimony, the arsenical ores of cobalt and nickel, &c. Certain sulphurets, which are not, however, numerous, have scarcely any action; such, for instance, as sulphurets of mercury and grey cobalt, which latter differs very much in that respect from grey nickel. Metallic iron resembles it in this particular, as it precipitates little, if any, of the silver in solution, under the form of concentrated ammoniacal chloride, or even under the form of a nitrate.

The power possessed by sulphurets, of decomposing chloride of silver, is generally greater in those which act by reduction than in those which produce a double decomposition; this power appears also to be proportionate to the electro-chemical state of the metals. It may also be mentioned, that the various minerals belonging to one kind, possess decomposing properties, varying according to their differences in composition, their crystalline form, and degrees of density and cohesion.

Bromide of silver, in the presence of the metallic sulphurets, presents the same phenomena of decomposition as the chloride. In short, all these facts appear to depend on a general law of the reaction of sulphurets upon chlorides, and of insoluble salts upon soluble salts. It has, moreover, been ascertained that these reactions are produced as well by the dry as the wet method; thus, galena decomposes chloride of silver in a state of fusion; and blend has been known to arrest the vapour of this chloride, and transform it into sulphuret of silver. The same vapour is also decomposed, by the help of heat, by quartz, feldspath, argil, and silicates generally.

The reactions of sulphurets upon chlorides (which, it has been noticed, are produced under conditions so various) have evidently a character of generality; and an observation of the metalliferous deposits tends to confirm this; chloride and bromide of silver not being found in the midst of metallic sulphurets, but in the upper part of the veins which have been changed and oxidized under the influence of exterior causes.

The explanation of certain geological phenomena is also arrived at by the above experiments; for instance,—the concentration of the ore of silver (both native and sulphuretted), which is found in the veins of Kongsberg, is found in contact and agglomerated with schistous strata, impregnated with various metallic sulphurets, iron and copper pyrites, blend, and galena.

TRANSACTIONS OF THE SOCIETY OF ARTS.

Dec. 12th & 19th, 1849.

The whole of the first and the greater part of the second of these evenings was occupied in hearing read and in discussing a paper on the application of electricity to the arts and sciences, by Mr. E. Highton, C.E.

Mr. Highton commenced by alluding to the many technical terms with which the science is encumbered, tending to retard the progress of the student. The principal means hitherto used for developing the power were stated to be the following:—Friction, chemical action, caloric, muscular power, and the relative position of bodies under peculiar conditions.

The connexion between electricity and magnetism was then briefly explained, and the peculiar phenomena of magnetic and diamagnetic bodies pointed out;—the author stating that all bodies have been found capable of assuming either the magnetic or diamagnetic state. The principal results produced by the action of electricity are thus enumerated:—1. Causing matter to assume certain definite positions. 2. The production of an attractive power. 3. The production of a repulsive power. 4. The production of positive or negative caloric. 5. The production of light. 6. The production of sound. 7. Chemical composition or decomposition. In short, the production, more or less, of all the other forces of nature.

The author then proceeded to point out the applications of electricity, briefly alluding to the electric telegraph; on which subject he had read a paper to the Society in the last session. He next pointed out various processes of electrotyping; the most recent of which was the copying of Daguerreotype pictures (specimens of which were exhibited); the delineation of architectural buildings; making transfers from engraved plates; engraving steel plates by means of a current of electricity from a platinum-point; and the application of the process of electrotyping, by Captain Ibbetson, to the preservation of the form of natural objects, such as animals, insects, plants, &c. Specimens of fishes, frogs, butterflies, spiders, leaves, and flowers of the most delicate structure, coated with metal, were exhibited. The process by which these objects are coated with metal is as follows:—As it would be impossible to coat the whole surface of the object with plumbago (which is the ordinary mode of preparing non-metallic substances for the process of electro-deposition), on account of the extreme delicacy and minuteness of some of the parts—the insect, leaf, or flower is first steeped in a solution of phosphorus, and afterwards in a solution of nitrate of silver; when the phosphorus causes the silver to precipitate upon the object, and thus form a very thin metallic coating over every part of the same; and upon this coating a thicker deposit of metal is obtained by the electro-

type process. When the required thickness of deposit has been obtained, two or three small holes are made through the coating, in parts where they will not be readily perceived; and then the specimen is subjected to such a degree of heat as will be sufficient to drive off, through the holes, all the moisture contained within it.

The application of electricity for measuring the velocity of bodies in their transit through space, in small periods of time, was alluded to; and an instrument for the purpose, invented by Professor Wheatstone, was exhibited and explained. The action of it is as follows:—An arrangement of mechanism allows a current of electricity to act upon an electro-magnet during the passage of the body from one point to another. The electro-magnet is attached to a train of wheels connected with a dial, the hands of which revolve at such a rate as to point out the 1000th part, or any other division, of a second. The current of electricity being allowed to act on the electro-magnet only during the passage of the body, permits the hands to progress only during such transit, and thus the time occupied is shewn on the dial. The experiments on falling bodies made by Professor Eisenlohr with this instrument were noticed.

The author then alluded to the application of electricity for ascertaining the temperature of water at great depths in the ocean; also for denoting a variation of temperature, to the extent of the 100th part of a degree, by means of thermo-electricity; the telegraphing of time at two stations, for ascertaining their difference of longitude; and its great value for blasting purposes.

He then alluded to electric clocks, and the latest improvements in their construction.

The application of electricity for printing on porcelain, the formation of lightning conductors, illumination, motive power, and medical purposes, were severally discussed.

The latter portion of the paper consisted of various suggestions for new modes of applying the power of electricity; one of which was the application to the art of war,—another for testing the quality of air in coal mines. Allusion was then made to its probable application, at no far distant date, to the manufacture of ice for domestic purposes.

The several theories of the formation of hail were explained, including those of Professor Müller, Volta, Prout, &c.; and then the author described his own theory of the formation of hail. He said that he could not agree with Volta's opinion, that in thunder storms there existed two layers of clouds, in different conditions of electricity; and a drop of water falling from the upper to the lower was instantly repulsed and thrown up again; and, by this repeated action, it became converted into ice and fell to the earth. Now, although during thunder and hail-storms there were often two or more series of clouds floating in the air, and in opposite electric conditions, yet they were continually seen form-

ing junctions, and merging into each other. He believed that as the vapour in these clouds condensed, drops of water were formed, and these increasing in size by contact with each other as they fell towards the earth, and increasing in velocity by two powerful agents acting in one direction—viz. their own gravity and the attraction of electricity—would give off a quantity of vapour, which, reducing the temperature of the remainder of each drop, would convert it into ice, and it would fall in the shape of hail. As an illustration of this formation of ice in an atmosphere so much hotter than itself, he called attention to the now well-known experiment of forming ice from sulphurous acid and water in a red-hot crucible.

The author concluded by remarking on the peculiar property of electricity in the production of direct circular motion (in which it differs from all other known forces in nature);—thus affording a valuable analytical test for determining whether certain other forces were simple and direct, acting in a straight line, or the result of a combination of forces acting in various directions. The application of this test to the motions of the heavenly bodies was also mentioned.

Numerous interesting specimens (illustrating the subjects referred to by Mr. Highton) were placed upon the tables. Amongst these were a solid silver salver, which had been deposited in a mould by electro-deposition; iron tubes coated with cadmium, so as to resemble brass; and *fac-similes*, in copper, of a large vase, from the British Museum, and a gigantic head of Ajax, which had been precipitated in a similar manner. Some beautiful specimens of intricate tracery-work, gilt and silvered in various proportions, were shewn; the manner of executing which, Mr. Highton said, he believed was kept a secret in the trade.

A member subsequently explained that the parts not intended to take the silver were drawn over with shellac, dissolved in spirits of naphtha; after the silvering was accomplished, the bituminous coat was removed by an alkaline or an acid solution, and the silver parts covered in like manner; the substance was then placed in the gold solution, when the parts exposed were gilt; and, on removing the coating from the silver, both would be found complete.

Mr. Highton said that, in the early stages of the invention, the deposited metal was found very soft; but Messrs. Elkington had told him that they can increase the hardness in proportion to the intensity of the galvanic current; and they had obtained silver, by electro-deposition, of a harder texture than could be obtained by any other means,—in fact, it was so hard, that it could scarcely be acted on by a file. With respect to the delicacy of depositing metal on fine tissues, he might mention that a friend of his (Capt. Ibbetson) was now engaged in electrotyping a spider's web.

In the discussion which followed the reading of the paper,

Mr. Cornelius Varley said that, on one occasion, with some scientific friends, he ascended a mountain during a heavy storm, regardless of the physical inconvenience of getting wet. At first the drops of rain were very large, but as they ascended they found them gradually decrease in size, till at a very considerable elevation they found themselves in a perfect vapour, such as is generally termed a Scotch mist, but intensely cold, which he attributed to the sun's rays above evaporating the upper surface of the cloud, and, consequently, abstracting caloric from that portion in which they stood.

Mr. Webster coincided in Mr. Highton's views of the formation of hail; but as the original causes of these phenomena must remain, to a great extent, matters of speculation, he wished to call the attention of the meeting back to the practical part of the subject. Mr. Highton had stated silver could be obtained more compact by the electrotype process than under any other circumstances;—he thought it would be highly interesting if some gentleman would further experimentalize, and ascertain the specific gravity of silver under these different circumstances.

Mr. R. Hunt, of the Museum of Economic Geology, said it should be borne in mind that the precious metals were deposited in a granular state, and that when finished they presented a surface of dead or frosted silver or gold; but that when required to be bright, they are rendered so by burnishing. If, however, a small portion of sulphuret of carbon be added to the solution, a deposit is obtained nearly as dense as cast metal, and requiring but little polishing. Could Mr. Highton throw any light on the *rationale* of this singular action?

Mr. Highton said, at present he had not sufficiently considered the subject to say he could.

Mr. Hunt, in continuation, said, it had been laid down by Dr. Faraday, that for every atom of zinc destroyed in the battery an equivalent of silver was deposited in the solution vessel; but Mr. Elkington had informed him that, by the addition of sulphuret of carbon, he could obtain a much larger amount of deposit than an equivalent for the zinc lost. A friend of his, Dr. Brond, had, for the last five years, devoted his time and energies to the obtaining electrotype copies of ancient works of art in the Vatican, at Rome, and other interesting ancient relics in different parts of Italy, with the view of getting them multiplied *ad infinitum*, and furnishing them at a cheap rate to the artizan and mechanic: this was a highly praiseworthy devotion, and would tend greatly to moralize the working man, and elevate the public taste. With respect to the application of electro-magnetism as a motive power, which had been alluded to by Mr. Highton, there were many difficulties of a serious nature to overcome, before it could be made available; particularly the decrease of magnetic power, as the distance from the object increased but a few lines; and from the fact that a current of electricity was induced in the metal, by

its moving in a contrary direction to the current which caused the magnetism, whereby a serious loss of power ensued, which increased with the increase of velocity. The most ingenious mechanical arrangement he had yet seen for applying this power, and obtaining length of stroke, was Mr. Hjorth's electro-magnetic engine, which gave a stroke of 18 inches. He had been for a very considerable period going through a series of experiments in galvanic electricity, particularly the deposition of metals, and he should request permission of the society, at a future day, to read a paper on the subject.

The Chairman said, the society would feel greatly obliged to Mr. Hunt for an account of his experiments and their results.

At the termination of the discussion on Mr. Highton's communication, the following paper was then read to the Society.

On an improved method of constructing buildings, whereby they are rendered fire-proof, without increase of cost. By Messrs. Fox & Barrett.

The vast amount of property annually destroyed by fire has occasioned public attention to be directed to the importance of having buildings constructed upon fire-proof principles; however, the general introduction of the system has been prevented by the prevailing idea of an increase of expense; but the author conceives that, by the proposed mode of construction, buildings proof against fire and dry-rot, and of superior strength and durability, may be constructed at the same cost as buildings not fire-proof.

The leading features of the proposed improvement are, the substitution of joists of wrought or cast-iron for those of timber; and the employment of successive layers of incombustible materials, supported by these joists, for the floor or roof. The author conceives that by this method great development of strength and firmness may be gained by the combination and consolidation of the materials into a complete mass. The joists are submitted to a test of 75 lbs. to 150 lbs. per square foot of flooring—being one-third of their breaking weight; but the increase of strength derived from the combination renders a floor capable of sustaining two or three times that weight. The joists are of a T-shape reversed. The upper surface of the web is of a curved form, and the bottom flange is either quite level or slightly cambered. The flange serves as a support for the strips and superincumbent layers of incombustible materials. The joists are placed about 18 inches apart for floors, and 24 inches for roofs, and have a bearing of about eight inches in each wall, with dove-tailed ends. In the construction of these floors and roofs, the short strips or laths, bearing on the flanges of the joists, may be made of any material; a coat of coarse mortar must be spread upon and pressed down between the strips, for the support of the ceiling laths; and upon this a layer of concrete or pugging, formed of

any material at hand, five inches thick for the floors of dwelling-houses, and nine inches for warehouses, is to be deposited. In forming concrete for roofs, it is desirable to use hydraulic lime, in proportion of 6 or 7 to 1, so as to have a water-tight foundation for the finishing coat of the roof. Thus a fire-proof foundation is obtained, upon which a floor or roof of any kind may be laid. It is preferable that the finishing coat for the floors be made of lime, sand, and ochre, with two coats of linseed-oil, applied by a brush; and that for the roof of Portland cement and sand.

The first house erected on this principle, sixteen years ago, by Dr. Fox, was Northlands, near Bristol.

The principal advantages in the proposed method of constructing the floors, ceilings, and roofs of buildings, may be thus stated:—They will be fire-proof in every room; economical, comfortable, and cleanly; perfectly dry and hard; impervious to smell or sound: admitting of the best plans for warming and ventilating; and proof against damp. The carpets are found to last longer. The roofs, being waterproof, are a greater protection against the weather; and the materials used being non-conductors, the rooms immediately beneath are not liable to those extremes of temperature which, during the heat of summer and the cold of winter, render the upper rooms in houses of the ordinary construction almost uninhabitable. Charges for repairs are reduced to a mere fraction, and insurance against fire is unnecessary. No tie-rods are required, there being an absence of all lateral thrust. The floors, from their arrangement, protect the joists from any concussion produced by the fall of a heavy weight. The method proposed affords a ready and inexpensive means of complying with the requirements of the Metropolitan Building Act. The author states that the proposed system can be carried out at a cost not greater than the ordinary mode of building, and gives as the cost of the floor of a room, 20 feet square, on the fire-proof plan, £20. 16*s.*;—timber floor, with sound boarding, &c., on the old principle, £30. 8*s.* 10*d.*

JANUARY 16TH, 1850.

MR. A. WALLS *read a paper on California, its products, climate, and prospects; being the result of a recent visit to that place by Alexander Cross, Esq.*

ON the table were placed a few specimens of Californian gold, one of which was a large lump, weighing about 7 lbs., being the largest ever imported into England in a pure native state, and the property of Mr. Cross; which, at £45 per lb., would be worth about £300, but was valued at a much larger sum, on account of its extraordinary character as a specimen. A few specimens were also exhibited by Professor Tennant. Mr. Walls commenced by stating the extent of the country, and its population, which, in-

cluding the recent accessions, amount at the present time to about 90,000 persons; although, in 1846, the population was only 14,000.

The country along the sea-coast is healthy; but fever is occasionally prevalent in the interior. After describing the situation of some of the principal stations, he proceeded to describe the valley of San Joachim, its extent, and boundaries, every spot in which is stated to have produced gold of 20 carats fine. Several extracts from various sources were briefly alluded to in the paper, and from these the following matters were collected.—Two young men had discovered gold in a place 500 miles north of San Joachim, and described their operations as having been attended with considerable success, having made in their best day 400 dollars, in their worst 150 dollars. As to the moral condition of the people, many of them became rich very quickly; but some expended their gains in profligacy and dissipation, so that the poorer class was fast increasing. The annual exports of gold from this country, according to Mr. Bryant's work on California, amounted to between 100 and 200 million dollars. In many places linen washing was so expensive, that it was considered more economical to throw away old linen, and buy new. Emigrants, as they arrived, passed beyond into the country, and were doing well. The general health of the community was excellent. The disparity of the produce of labour in various parts sometimes occasioned considerable confusion. A new settler, in about three weeks, would succeed, by washing, in obtaining an ounce of gold a-day; but the moment that he hears that at a distant place others were washing three ounces, he immediately packs up his things, goes away, and is generally disappointed.

Mr. Tennant stated that the specimen of gold exhibited by Mr. Walls was evidently a water-worn fragment. The gold is usually found in small grains, which are obtained by washing the alluvial soil; and 90 per cent. of the gold collected is of this description.

He also exhibited a specimen of gold, weighing 9½ ounces, which, at the time he had purchased it (about two months before), was the finest specimen of pure native gold he had seen. It contained 92 per cent. of pure metal. A reason he had for purchasing the specimen was, because it had some of the alluvial soil attached to it; and in that soil he imagined that one or two small diamonds might be detected, and was most anxious to ascertain that fact, as he had stated to the Society last Session, in a paper, that diamonds, and other precious stones, might be found in the gold districts of California; and that such gems are being thrown aside, although the refuse diamonds sold to the lapidary to be broken up are worth £50 per ounce, while gold is not worth more than £3. 15*s*. He had not, however, been able to discover any diamond; but, on examining the soil with the microscope, he had detected some small crystals of garnet, 2 grains of platinum, and several of quartz, &c. In looking over a quantity of other

gold specimens, he had found quartz in great abundance, and it had evidently formed the original matrix of the gold. He next called attention to the fact, that gold is not generally found in the position in which it was originally deposited. Mr. Tennant urged on the attention of persons about to visit the gold districts the necessity of making themselves acquainted with the few simple rules which should guide them in their search for gold and other minerals, and which were published in the Society's Circular last Session. He remarked that a much larger quantity of gold had been imported into this country from California than was generally imagined, and stated that one house in London had received upwards of 10 tons of gold dust during the past year.

Mr. Hopkins stated there was nothing unusual in the gold deposits of California. The gold was found precisely under similar circumstances as the deposits of the Ural, in Russia, and some other places. When the west tributaries of the Sacramento and the San Joachim have been washed, California will doubtless be brought to the ordinary level of large gold-producing countries. He was of opinion that metals were formed in the crystalline rocks in flakes, masses, crystals, arborescent, &c., according to the degree of the electro-chemical action; and that this action, in the moist crystalline rocks *in situ* was as constant as the growth of vegetation. The surface products and the veins, he said, were formed on the same principle. He perfectly agreed with the remarks that were made, that those called geologists and others, who have been led to suppose that such products were the result of volcanic action, were totally wrong. He said that the ridge of Cordilleras, from Chili to California, will all produce gold. Wherever the ferruginous granite is found, gold will also be found, but in a state of minute division, so that it will scarcely pay for working: it is only in ravines that great deposits occur. Mr. Hopkins concluded by stating that gold is generally found in the debris of ferruginous granities and porphyries, and that the quantity of gold to be obtained depends on the elementary composition of the granitic rocks,—the complete saturation to induce chemical action, so as to cause a kind of efflorescence of the metals into all joints, vacuities, &c.,—and the oxidation and disintegration of the superficies. In fact, the superficial decomposition of the moist and friable auriferous rocks are more or less constant,—the degree of action and the accumulations at the foot of the mountains being dependent solely on mineral and physical conditions, confined to no age of rocks nor to any particular zone; and this electro-chemical agent is constantly providing inexhaustible stores of mineral wealth for successive generations. When the decomposed and friable surface is washed down to the ravines and plains, the gold and other heavy ingredients, especially the black titaniferous iron (the usual companion of the precious metal), are deposited in pools and other places, presenting obstacles to their descent, and consequently those places become en-

riched by concentration, the lighter particles being constantly washed away; and that this is the origin of the riches of the tributaries of the Sacramento. He also spoke of the state in which silver is found, and the means adopted for obtaining it in a metallic form.

JANUARY 23RD.

The first part of a paper by MR. A. G. FINDLAY, M.R.G.S., *on artificial breakwaters, and the principles which govern their construction, was read.*

MR. FINDLAY's paper commenced by stating, that it was not wished to pronounce upon the feasibility or impracticability of any of the numerous plans which have, from time to time, been proposed for the construction of breakwaters, but to submit some facts, drawn from natural effects, shewing the forces to which such structures must be subjected.

The paper, therefore, was naturally divided into two parts. The first, which related to the action of the waves, and its collateral subjects; and the second, which was postponed for a future evening, will relate to the various forms which have been given to sea-barriers, and the history of the progress of those now in existence.

The principal difficulty in establishing a fixed breakwater was shewn to be the enormous force of the waves. The form and nature of sea-waves generally were alluded to, and Mr. Scott Russell's system described. Of the dynamic force exerted by sea-waves, it was stated that their greatest force was at the crest of the wave before it breaks; and its power in raising itself was measured by a number of facts. At Warberg, in Norway, it rose 400 feet, January 21st, 1820: on the coast of Cornwall it rose 300 feet in 1843. Other examples, as the singular "Souffleur" at the Mauritius, &c., were cited, shewing that the waves have raised a column of water equivalent to a pressure of three to five tons per square foot; a result in accordance with Mr. T. Stevenson's observations with the Marine Dynamometer, which was described. The mode of measuring the height of a wave, as recommended by Arago, was to ascend the rigging of a ship until, to the eye of the observer, the crest of the wave is level with the horizon; and from the height thus ascended the height of the crest above the hollow of the wave may be calculated.

It was shewn by a table that the velocity of waves was dependent on their length; that waves of 300 to 400 feet in length from crest to crest, travelled with a velocity of 20 to 27½ miles an hour, and this whether they were 5 or 54 feet in total height: this velocity alone, should they become primary waves of translation, would give them a great percussive force. That waves travel very great distances was instanced by several facts. That they are raised by distant hurricanes and gales was noticed, by their being felt simultaneously at St. Helena and Ascension, though 650 miles apart; and opinions quoted, that these rollers,

or ground-swell, at times originated near Cape Horn, 3000 miles distant; rendering it more than probable that tropical hurricanes will send storm-waves to our own shores.

That it was not only at their surface that waves exerted great power, but that they reach, in their action, to the depth of eight fathoms and upwards, was shewn by the operations for the recovery of the treasure from H.M.S. Thetis, which was wrecked and sunk at Cape Frio, Brazil, in 1831. The diving-bell was swung four or five feet laterally in calm weather in these operations, much increasing their danger. Besides this, the guns and treasure were found covered by masses of rock of from thirty to fifty tons weight, moved by the action of the water, and weighed or turned over in the second operations by Captain De Roos.

From these facts, it was considered that floating breakwaters generally were not adapted to combat with the waves. Admiral Tayler's plan of timber frame-work sections; Captain Grove's iron cylinder, with an iron grating hanging below; Captain Pringle's frame, moored by its lower edge; Captain A. Sleigh's floating sea-barrier; Mr. Smith's plan, as submitted to the Society, were mentioned; and it was considered that the calculations of their resistance were understated; that Admiral Tayler's section, instead of twenty-five tons' strain, might, if the waves exerted only one-third of their force, as known, have to withstand upwards of 1000 tons: this probably caused the failure of Admiral Tayler's experiment at Brighton, and Captain Grove's at Dover. Major Parlby's principle of the trumpet-mouthed sea-weed was compared with the *fucus giganteus* of Dr. Solander, abundant on the Patagonian and Fuegian coasts, and 360 feet in length,—which is carried under water in currents, and torn up, and chokes all the bays during storms.

The motion of shingle, an important consideration in establishing breakwaters, was shewn to be governed by the direction in which the surf strikes the shore,—and this is dependent on the direction of the wind. This, from 15 years' observation by M. Nell de Bréauté, at Dieppe, was shewn to be in the ratio of 229 days from western quarters to 132 days from eastern quarters; giving that preponderance to its eastward progress. The mode in which it was arranged on the sloping beach, in the form of a paraboloidal curve, was explained.

Sand, a more powerful agent than shingle in changing the character of a coast, was stated to be deposited by currents; thus rendering the eastern parts of the English Channel much more embarrassed by them than the western portion. The Goodwin Sands were exhibited as examples of the extent of accumulation, and the changeable character of sand deposits. The diagrams exhibited shewed the progress of these alterations, and were drawn from, perhaps, the only authentic history we possess of the changeable character of a quicksand. The different periods, from Græme Spence's survey in 1795, down to Captain Bullock's

in 1849, shewed that they had shifted miles in their position and area, evidently refuting the practicability of any principle which would apply to fixing them, and rendering them available more perfectly for breakwater purposes, as was proposed by Captain Vetch, R.E. to the Royal Commission, 1845.

The second part of the paper, which applies the previous remarks to the structures existing or in construction, and the various forms proposed for breakwaters, with the history of their progress, was postponed until Wednesday, February 6.

TRANSACTIONS OF THE INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

(Continued from p. 440, Vol XXXV.)

The following paper was read by Mr. Sampson Lloyd, of Wednesbury :—

ON GEORGE NASMYTH'S PATENT GIRDERS AND FIRE-PROOF FLOORS.

The invention or peculiar construction of Girders, Fire-proof Flooring, Roofing, &c., which forms the subject of the following paper, mainly consists of the adaptation of the "Bow and String" principle to the various objects required; and the method adopted in the construction of these works was explained to the meeting by Drawings and Models.

1.—*The Invention as applied to Fire-proof Floors for Buildings.*

The size and probable weight that the floor will be required to bear being ascertained, plate iron is taken of the required size and strength, and is bent in the form of an arch; and another plate is taken for the underside, which is turned up at each end; taking care that the space left between the turned up ends is of such a length as to retain the upper plate in its bent form. This bottom plate is not required to be of the width of the top plate, unless an even surface is wanted,—a strip of bar-iron or steel of the required strength will answer the purpose; neither is it absolutely requisite to have the top plate of the form of an arch. When the top plate is bent and placed within the turned up ends of the bottom plate, it is ready for fixing between the wall beams or girders. In all cases the under plate or tension bar should, to secure perfect safety, be of double the strength that is estimated to be requisite.

The strength will be in proportion to the weight to be placed on the top plate; the turned up ends act as the abutments of the upper plate, and each plate with its tension bars or plate becomes perfectly self-contained, and has not the slightest lateral pressure on the beams or girders on which it rests.

The entire weight which may ever be on such floor will act on the wall beams or girders by a crushing force, which is the most

favorable and perfectly free from any lateral action, so long as the tension bars or plates exist.

There is another great advantage in this construction; the bays or spaces between the walls or girders may be wider than when brick arches are used, and of less thickness; and further, if from any unforseen cause one or more of the plates of the flooring were to give way, no other damage would take place to any other part of the floor; each plate being quite independent, and in no other way bound to either walls or girders.

2.—*The Application to Girders.*

Girders, in the first place, may be considered simply as a bow and string of the required lengths; on the bow a second arch, provided with side plates, and exactly corresponding with the outside of the bow, is placed. This forms a complete case over the bow,—and when the girder is weighted, the arch being restrained from flattening or altering its shape by the case, the entire weight comes as a direct strain on the tension bar or string. There is no fixture or attachment to the tension bar, except at the ends, and the internal bow or string is perfectly free from the case, as shewn in the models.

Supposing a weight were suspended from the string of a bow, the effect would be to raise the crown of the bow; whereas, if the same weight were applied to the case covering the bow, the effect would be to spread the strain in the most uniform manner all over the bow, and transmit the whole weight into the chord or tension bar. For example:—If a girder, 20 feet long, had 20 tons placed on the centre, on this principle each foot of the girder would bear one ton, and the tension bar would have to sustain 20 tons. In bridges, as at present constructed, it is customary to connect the arch to the string in such a manner that there must be a tendency to deflect between every connecting plate. The same effect is produced where the girders are formed by applying the pressure over the top of the arch,—there is no uniform pressure or tension; whereas, on this principle, the weight can either be placed on the arch, or suspended, as in the drawing, which represents a bridge and roadway; and in every case, if the load be placed in any varying position, the pressure and tension will be uniform. The rise of the arch from the chord has hitherto been made equal to one inch to the foot in length, and the arch constructed by placing plates of cast or wrought-iron between angle-iron; but there are other methods, as circumstances may require.

When the string or tension bars are too long for one plate, it is proposed to use a series of links, such as are used in suspension bridges; and from the great length such chains can be formed, there does not appear any precise limit to the span to which girders or bridges may be carried. The chains themselves can be used as an element of increased strength, by laying them on each side of the roadway, which, being suspended from the case covering the arch, will be found to have the effect of giving rigidity.

The roadways in bridges are formed of a series of cross-girders, and between them arched plates are laid, as in floors, and then filled in with ballast, as required. For bridges, on this principle, no abutments of any kind will be required, all the weight being downward.

Beams or girders can be constructed of very great span, as the tensional action is the same; and to prevent the tendency to sag in the tension bars, light supports are easily placed under them, attached to the bow or case, as most convenient.

For warehouses and large rooms, where a clear space may be of consequence, the advantage of this construction of girder will be felt in a striking manner, there being no outward thrust on the walls, which may consequently be built thinner than usual; and there is no necessity for stay bolts.

Girders can be made to sustain any given weight, quite independent of the span, and with a peculiar advantage; viz., if a girder was made to sustain 20 tons, the same girder can be made to sustain 40 tons without making it one inch deeper; for, to attain this object, it is only necessary to increase the width of the case and insert one or two additional arches and tension bars, as may be required,—thus only making the girder wider, which, in buildings, is often of great importance.

3.—*The Application to Roofs.*

When the patent construction is applied to roofing, the extreme lightness will be the chief feature. The bow and tension-bar form the principal, and plate iron, timber, or any other suitable material, is employed for covering the saddle or arch-case.

4.—*The Application to Bridges.*

This invention is peculiarly adapted for bridges, as previously stated; but there are many advantages not mentioned, one or two of which may be alluded to. When the foundations on which the pier of a bridge rest are bad, the freedom from lateral pressure is of great importance; also in viaducts, where simple pillars or piers are built. In bridges of wide span, the outside girder can be made of sufficient depth by making the arch of the girder and case serve for the parapet.

5.—*Dock Gates and Caissons.*

The principle is applicable to the construction of dock gates and caissons, particularly to such as are of large dimensions. In such constructions the tension-bar may be in the centre, with an arch and case on each side, capable of resisting equally the weight of water on either side.

6.—*Jetties or Piers.*

Jetties or piers may be advantageously constructed on this principle, and may be made to extend a considerable distance for a comparatively small cost. For instance,—a foot bridge or pier

may be constructed to rest on the land in the usual way, on the one end, and on a barge at the other, rising and falling with the water.

In conclusion, it may be observed, the advantages attained by this invention are, that in *fire-proof buildings* the walls are free from lateral thrust; the floors may be made thinner, and the number of stories be safely increased; rooms of a large size may be constructed without any pillars or supports except the outer walls, at a much less cost than in the ordinary construction. Floors on this construction are fire-proof, are easily made to sustain any given weight, or to support an increased weight, and are not liable to be destroyed by decay or vermin; and no part of the floor, by giving way, will cause an extra strain on the other parts, as the whole floor is formed of self-contained and independent parts.

In *girders,* by the combination of wrought-iron, cast-iron, and steel, their strength, form, or weight, may be adapted to meet almost all circumstances; and larger spans in *bridges,* &c. can be adopted with a much less consumption of materials than in other constructions,—besides taking into consideration the slight support required from the absence of lateral thrust.

From experiments which have been made, it has been ascertained that the comparative strength of these girders, when compared with cast-iron, is as 7 to 28, or four times as strong: that is, a girder that would weigh 4 tons in cast-iron, to carry a certain weight, can be constructed to carry the same weight on this principle, and will only weigh 1 ton.

Mr. Lloyd regretted that Mr. Nasmyth was not present, as he would have been much better prepared to explain the principle of the girder, and answer any objections that might be raised. Mr. Nasmyth had intended to be present at the meeting, but was unexpectedly prevented from attending.

The Chairman observed, that the bar of wrought-iron which was employed as an arch in the girder, was not capable of sustaining much compression without buckling; and he could not understand why wrought-iron was introduced into arches, when the arch was the best possible form for the adoption of cast-iron.

Mr. Lloyd replied, that though cast-iron would bear a greater compression, the introduction of wrought-iron facilitated the distribution of the pressure over the whole girder. The longitudinal box that was placed over the arched rib distributed the pressure over the rib, and prevented it from buckling, and the whole strain was conveyed to the tension bar.

Mr. Cowper thought the proposed construction involved the employment of a large quantity of metal which was of no possible service; particularly the metal in the ends of the box of the girder, which did not appear to give any addition to the strength. He should be glad to know the results of experiments on the

comparative strength of the girder; and he much doubted the applicability of the plan to girder bridges. He suggested that it would be better to make the wrought-iron box in the form of an arch and put it in the place of the arched rib, which he considered would give the same strength with much less material.

The Chairman remarked, that he did not see where the principle of the bow-and-string girder differed from that of the girder bridges erected on the North Western Railway at Camden Town and Buckby.

Mr. Henderson thought the principle was the same, only adopting wrought-iron instead of cast-iron for the arched rib, and that cast-iron was much preferable for the purpose; he believed the introduction of wrought-iron had been caused by the public apprehension with reference to cast-iron girders of large span. It appeared to him that the plan proposed for distributing the weight upon the girder, by covering it with a wrought-iron box, was objectionable both in theory and practice, and involved a waste of material; and he considered the most economical and scientific way of doing it was, by the introduction of diagonal side-pieces between the arched rib and the tie, instead of continuous side plates.

The Chairman agreed with the suggestion of Mr. Cowper, that it would be preferable to combine together the box and the rib; but instead of putting the material in the form of an arch, he thought it would be better to carry it straight along the top. The upper portion was entirely subjected to compression and the lower portion to tension; and when the parallel form was adopted the compression and tension acted by the same leverage at all parts of the girder; but when thrown into the arch form, this leverage was so much diminished towards the ends, on account of diminished depth of the girder, that the thickness would require increasing there to obtain sufficient resistance, which involved an increase in the quantity of material employed.

Mr. Cowper thought this increase would be slight, compared with the saving of material effected at the ends, by adopting the arched form instead of the straight top. In the parallel box-girder, formed with side-plates, the strain passed down obliquely through the side-plates to the lower part of the girder at each end, and the plates were required to be thicker at that part; but he thought the better plan was to place the material in the direction of this strain by making the box-girder in the form of an arch and tying the ends together by the tension bars.

Mr. Slate was of opinion that a cast-iron rib with a wrought-iron tie was the most economical and efficacious application for the girders of railway bridges.

The Chairman remarked, that with some variation the proposed plan might be satisfactorily adopted for supporting the floors of warehouses,—but he thought there would be great difficulties in applying it to bridges of large span.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Jan. 2. *John Lart & Son*, of Wood-street, Cheapside, and Rutland-street, Nottingham, for an elastic back-piece, for cotton and other drawers.

4. *John Wilson*, of 20, St. Ann's-street, Manchester, tailor and draper, for an elastic riding belt.

4. *Henry Stephenson*, of Howley-street, Lambeth, for the rotatory double-action atmospheric churn dasher.

5. *Henry Moore Naylor*, of Birmingham, for a hook and eye.

7. *Edwin Kesterton*, of 80, Long Acre, for an improved carriage (the Akolaston).

7. *Deane, Dray & Deane*, of King William-street, City, for an improved gas stove.

8. *George Church*, of 12, Berkeley-place, Clifton, Bristol, musical instrument maker, for a wrist supporter, for facilitating the practice of the piano-forte, organ, or seraphine.

8. *Richard Townley*, of Cursitor-street, London, for a plat or plait.

9. *John Cornes*, of Carrow Works, Norwich, agricultural implement maker, for a dressing machine.

9. *Edward Grey Williams*, of 11, Dover-street, Everton, Liverpool, millwright, for a screen and smut machine.

9. *Peter Hunter Irvin*, of Hope-terrace, Notting-hill, for a portable wash-hand-stand and dressing case.

10. *James Parks & Son*, of Birmingham, for a rule.

10. *Williams & Son*, of Birmingham, for a snuff-box.

10. *Myer Myers*, of Birmingham, for a pen-holder.

11. *George Cubitt*, of North Walsham, agricultural implement maker, for hand power for winnowing, thrashing, and chaff-cutting machines.

14. *William Henry Muggleton*, of Tottenham, for a type-frame.

14. *Louis Rodolph Bodmer*, of Manchester, in the county of Lancaster, engineer, for an improved door-spring.

14. *Westhead & Co.*, of Manchester, for the "respirator cravat or fog repellent."

16. *Blackburn & Higgin*, of Bethnal-green-road, shirt-makers, for a fronted vest for gentlemen and ladies.

16. *George Jacobs*, of Cockspur-street, Charing-cross, for a fan riding whip.

19. *Joseph Gray & Henry Lawson*, of 37, Eldon-street, Sheffield, for a continuous stream enema fountain syringe.

Jan. 19. *Robert John Blyth*, of the Eagle Foundry, Ber-street, Norwich, engineer, for a drum for thrashing corn, &c.

22. *John Roberts*, of 34, Eastcheap, in the City of London, spice merchant, for a ventilating flower-pot.

22. *Henry Charles James*, of 372, Oxford-street, Middlesex, trunk-maker, for the "collapsible trunk or portmanteau."

23. *John Samuel Phené*, of Cambridge, for a hook and eye.

23. *James E. Mac Cabe*, of No. 23, Parliament-street, Westminster, for covers and back for binding, or the temporary binding, of pamphlets, music, printed, and other papers and documents.

24. *Joseph Welch & John Margetson*, of 17, Cheapside, London, for the "equestrian or driving poncho."

24. *Henry Barrage*, of 2, Bath-buildings, Baldwin-street, City-road, for a triangular ventilating top for chimneys.

26. *White & Grant*, of Dalmarnock-road, Glasgow, for a safety-cage and disengaging-catch for mine-shafts.

26. *John Sherratt & Charles Pickering*, of Trafalgar-street, Walworth, for a bottle-neck and stopper.

26. *John Head Hopkins & Son*, of Birmingham, for an apparatus for heating water for baths and other vessels.

28. *Thomas Kennedy*, of Kilmarnock, gun-maker, for a waterproof gun-nipple.

28. *Benjamin Levy*, of 324 and 325, High Holborn, clothier, &c., for the "expanding vest."

List of Patents

That have passed the Great Seal of IRELAND, from the 17th December, 1849, to the 17th January, 1850, inclusive.

To Osgood Field, of London, merchant, for improvements in anchors,—being a communication from abroad.—Sealed 4th January.

Peter Fairbairn, of Leeds, in the county of York, machinist, and John Hetherington, of Manchester, in the county of Lancaster, machinist, for certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances,—being a foreign communication; and also of improvements made by them.—Sealed 12th January.

Richard Hobson, of Leeds, in the county of York, Doctor of Medicine, for certain improvements in the manufacture of

horse-shoes, and in apparatus for taking the measurement of horse-shoes or horses' hoofs.—Sealed 15th January.

Thomas Auchterlonie, of Glasgow, North Britain, manufacturer and calico printer, for improvements in the production of ornamental fabrics.—Sealed 17th January.

Winceslas Baron de Traux de Wardin, of Liege, in the province of Liege, in the Kingdom of Belgium, for certain improvements in looms for weaving linen, woollen, and cotton cloths, and in machines for preparing the yarns for such cloths before entering the loom; and in a machine for finishing grey and bleached linen cloths.—Sealed 17th January.

John Jordan, of Liverpool, in the county of Lancaster, engineer, for certain improvements in the construction of ships and other vessels navigating on water.—Sealed 17th January.

List of Patents

Granted for SCOTLAND, subsequent to December 22nd, 1849.

To John Stoughton Christie, of 13, Craven-street, Strand, London, for an improved construction of wrought-iron wheels, and machinery for effecting the same,—being a communication.—Sealed 24th December.

James Usher, of Edinburgh, for improvements in machinery for tilling land.—Sealed 24th December.

Dr. Richard Hobson, of Leeds, for certain improvements in the manufacture of horse-shoes, and in apparatus for taking the measurement of horse-shoes or horses' hoofs.—Sealed 26th December.

William Ackroyd, of Birkenshaw Mills, near Leeds, for improvements in dressing and cleaning worsted and worsted mixed with cotton and other fabrics, after they have been woven,—being a communication.—Sealed 31st December.

John Christophers, of Heavitree, Devonshire, merchant, for improvements in naval architecture.—Sealed 31st December.

Alexander Brodie Cochrane, jun., and Archibald Slate, both of Dudley, engineers, for improvements in the manufacture of iron pipes or tubes.—Sealed 31st December.

Joseph Burch, of Coney Works, near Macclesfield, engineer, for improvements in printing on cotton, woollen, silk, paper, and other fabrics and materials.—Sealed 31st December.

John Barsham, of Kingston, Surrey, manufacturer, for improvements in separating the fibre from cocoa-nut husks.—Sealed 31st December.

Winceslas Le Baron de Traux de Wardin, of Liege, in the province of Liege, Belgium, for certain improvements in looms for

weaving linen, woollen, and cotton cloths, and in machines for preparing the yarns for such cloths before entering the loom; and in a machine for finishing grey and bleached linen cloths. --Sealed 3rd January.

William Henry Wilding, of the New-road, for certain improvements in engines and machinery for obtaining and applying motive power.—Sealed 4th January.

Charles Cowper, of Southampton-buildings, London, patent agent, for improvements in machinery for raising and lowering weights and persons in mines, and in the arrangements and construction of steam-engines employed to put in motion such machinery; part of which improvements are applicable to other useful purposes,—being a communication.—Sealed 4th Jan.

Reuben Plant, of Holly Hall Colliery, near Dudley, coal master, for improvements in making wrought and bar iron.—Sealed 7th January.

Samuel Colt, of Trafalgar-square, London, for improvements in fire-arms.—Sealed 7th January.

Thomas Lightfoot, of Broad Oak, within Accrington, county of Lancaster, chemist, for improvements in printing and dyeing fabrics of cotton and of other fibrous materials,—partly a communication and partly his own.—Sealed 7th January.

Thomas Richardson, of Newcastle-upon-Tyne, chemist, for improvements in the manufacture of Epsom and other magnesian salts; also alum and sulphate of ammonia.—Sealed 11th January.

Jerome Andre Drieu, of Manchester, machinist, for certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith.—Sealed 14th January.

Thomas Auchterlonie, of Glasgow, manufacturer and calico printer, for improvements in the production of ornamental fabrics. —Sealed 14th January.

Andrew Barclay, of Kilmarnock, engineer, for improvements in the smelting of iron and other ores, and in the manufacture or working of iron and other metals; and in certain rotatory engines and fans, machinery or apparatus, as connected therewith. —Sealed 14th January.

Pierre Armand Le Comte de Fontainemoreau, of 4, South-street, Finsbury, London, English and Foreign Patent Office, for improvements in spinning fibrous substances,—being a communication.—Sealed 16th January.

Joe Sidebottom, of Pendlebury, Lancaster, manager, for certain improvements in steam-engines.—Sealed 16th January.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, engineer, for certain improvements in pumps, and in machinery or apparatus for working the same; which latter improvements are also applicable for working other machinery,—being a communication.—Sealed 18th January.

Robert Wilson, of Low Moor Iron Works, Bradford, for improvements in steam-engines and boilers, and methods of preventing accidents in working the same.—Sealed 21st January.

John George Barlow, of Regent's-park, London, for certain improvements in dyeing and dyeing materials,—being a communication.—Sealed 21st January.

New Patents
SEALED IN ENGLAND.
1849-50.*

To Louis Cesaires Charpillon, of Rue de Luxembourg, in the Republic of France, for improvements in locks for guns and pistols. Sealed 29th December—6 months for inrolment.

John Read, of Park-terrace, King's-road, Chelsea, Gent., for improvements in machinery for extracting fluids from animal, vegetable, and mineral substances, and in compressing the same. Sealed 29th December—6 months for inrolment.

William Palmer, of Sutton-street, Clerkenwell, in the county of Middlesex, manufacturer, for improvements in the manufacture of candles, lamps, and wicks. Sealed 29th December—6 months for inrolment.

William Barlow, of Blackheath, civil engineer, and William Henry Barlow, of Derby, civil engineer, for improvements in the permanent ways of railways. Sealed 3rd January—6 months for inrolment.

Albert Crakell Waterlow, of London-wall, lithographer, for improvements in the means and apparatus for obtaining copies of writings, drawings, and other designs,—being a communication. Sealed 3rd January—6 months for inrolment.

Alexander Brodie Cochrane, jun., and Archibald Slate, of Dudley, in the county of Worcester, engineers, for improvements in the manufacture of iron pipes or tubes. Sealed 3rd January—6 months for inrolment.

Thomas Lightfoot, of Broad Oak, within Accrington, in the county of Lancaster, chemist, for improvements in printing and dyeing fabrics of cotton, and of other fibrous materials. Sealed 3rd January—6 months for inrolment.

William Buckwell, of the Artificial Granite Works, Battersea, civil engineer, for improvements in compressing or solidifying fuel,—to extend to the Colonies only. Sealed 3rd January—6 months for inrolment

Joe Sidebottom, of Pendlebury, in the county of Lancaster,

* Instead of the date given to Spray and Nevett's patent in our last list, it should read "December 21st."

manager, for certain improvements in steam-engines. Sealed 3rd January—6 months for inrolment.

Henry Dorning, of Kearsley, near Bolton, in the county of Lancaster, brick and tile manufacturer, for certain improvements in machinery or apparatus for manufacturing bricks, tiles, and other similar articles, from clay or other plastic materials. Sealed 3rd January—6 months for inrolment.

David Blair White, of the borough of Newcastle-upon-Tyne, Doctor of Medicine, for an improved mode of ballasting and stowing cargo in ships and other vessels. Sealed 8th January—6 months for inrolment.

Matthew Urlwin Sears, of Burton-crescent, St. Pancras, commission agent, for the improved construction of guns and cannons and manufacture of cartridges for the loading or charging thereof,—being a communication. Sealed 11th January—6 months for inrolment.

Samuel Newington, of Knole Frant, in the county of Sussex, Doctor of Medicine, for improvements in sowing, manuring, and cultivating land; and in certain of the implements used therein. Sealed 11th January—6 months for inrolment.

Bennett Alfred Burton, of the firm of Bennett, Burton, and Burton, of John's-place, Holland-street, Southwark, engineer, for certain improvements in apparatus connected with sewers, drains, and cesspools; also in suction and delivery pipes, and in connecting such pipes or hose,—the apparatus connected with sewers, drains, and cesspools, being applicable to other like purposes. Sealed 11th January—6 months for inrolment.

John Fayrer, of Surrey-street, Strand, Commander in Her Majesty's Royal Navy, for improvements in steering apparatus. Sealed 11th January—6 months for inrolment.

Alfred Cooper, of Rumsey, in the county of Hants, grocer, for improvements in steam and other power engines, and in the application thereof to motive purposes; also in the method of, and machinery for, arresting or checking the progress of locomotive engines and other carriages. Sealed 11th January—6 months for inrolment.

James Mc Donald, of the City of Chester, coach-maker, for certain improvements in the mode of applying oil or grease to wheels and axles, and to machinery; and in connecting the springs of wheel-carriages with the axles or axle-boxes. Sealed 11th January—6 months for inrolment.

John Glasgow, of Manchester, engineer, for certain improvements in machinery or apparatus for shearing, shaping, punching, and compressing metals. Sealed 12th January—6 months for inrolment.

John Milwain, of Manchester, in the county of Lancaster, joiner, for certain improvements applicable to the closing of doors, windows, and shutters. Sealed 12th January—6 months for inrolment.

Andrew Barclay, of Kilmarnock, in the county of Ayr, North Britain, engineer, for improvements in smelting of iron and other ores, and in the manufacture or working of iron and other metals; and in certain rotary engines and fans, machinery, or apparatus, as connected therewith. Sealed 15th January—6 months for inrolment.

Richard Smith, of Clitheroe, in the county of Lancaster, manufacturer, for certain improvements in looms for weaving. Sealed 17th January—6 months for inrolment.

Henry Cowing, of Stamford-street, Blackfriars, in the county of Surrey, Gent., for improvements in obtaining motive power, and in steam and other ploughs, in land carriages, in fire-engines, in raising water for draining and other agricultural purposes, and in apparatus for evaporating saccharine and other liquors. Sealed 17th January—6 months for inrolment.

Joseph Nye, of Mill Pond Wharf, Park-road, Old Kent-road, engineer, for improvements in hydraulic machinery; parts of which improvements are applicable to steam-engines and machinery for driving piles. Sealed 17th January—6 months for inrolment.

Robert Barbor, of Chatham-place, Locks-fields, in the county of Surrey, metal smelter, for certain improvements in artificial fuel, and in machinery used for manufacturing the same. Sealed 17th January—6 months for inrolment.

William George Henry Taunton, of Liverpool, in the County Palatine of Lancaster, civil engineer, for certain improvements in obtaining and applying motive power, and in a means to ascertain the strength of chains and ships' cables. Sealed 17th January—6 months for inrolment.

Macgregor Laird, of Birkenhead, Gent., for improvements in the construction of metallic ships or vessels, and in materials for coating the bottoms of iron ships or vessels; and in steering ships or vessels. Sealed 19th January—6 months for inrolment.

William Beadon, jun., of Taunton, in the county of Somerset, Gent., for improvements in conveying away or decomposing smoke and products of combustion from stoves or grates, and in ventilating rooms of residences. Sealed 19th January—6 months for inrolment.

George Simpson, of Buchanan-street, Glasgow, North Britain, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies. Sealed 19th January—6 months for inrolment.

William Wood, of Over Darwen, Lancashire, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics. Sealed 23rd January—6 months for inrolment.

Christopher Nickels, of York-road, Lambeth, in the county of Surrey, Gent., for improvements in the manufacture of woollen

and other fabrics. Sealed 23rd January—6 months for inrolment.

Walter Westrup, of Wapping, in the county of Middlesex, miller and biscuit baker, for improvements in cleaning and grinding corn or grain, and dressing meal or flour. Sealed 24th January —6 months for inrolment.

Auguste Reinhard, of Leicester-street, Leicester-square, chemist, for improvements in preparing oils for lubricating purposes, and in apparatus for filtering oil and other liquids. Sealed 24th January—6 months for inrolment.

Joseph Long and James Long, of Little Tower-street, in the City of London, mathematical instrument makers, and Richard Pattenden, of Nelson-square, in the county of Surrey, engineer, for an improvement in instruments and machinery for steering ships; which is also applicable to vices and other instruments and machinery for obtaining power. Sealed 24th January—6 months for inrolment.

John Dalton, of Hollingworth, in the county of Chester, calico printer, for certain improvements in and applicable to machinery or apparatus for bleaching, dyeing, printing, and finishing textile and other fabrics, and in the engraving of copper rollers and other metallic bodies. Sealed 26th January—6 months for inrolment.

Edwin Heycock, of Leeds, in the county of York, merchant, for certain improvements in the finishing and dressing of woollen cloths. Sealed 26th January—6 months for inrolment.

Thomas Richardson, of the town and county of Newcastle-upon-Tyne, chemist, for improvements in the manufacture of Epsom and other magnesian salts; also alum and sulphate of ammonia. Sealed 26th January—6 months for inrolment.

Winceslas Le Baron de Traux de Wardin, of Liege, in the province of Liege, in the kingdom of Belgium, for certain improvements in looms for weaving linen, woollen, and cotton cloths, and in machines for preparing the yarns for such cloths before entering the loom,—and in a machine for finishing grey and bleached linen cloths. Sealed 26th January—6 months for inrolment.

Thomas Schofield, of Combrook, Hulme, near Manchester, in the county of Lancaster, fustian dyer and finisher, and Henry Horabin, of Royton, near Oldham, in the same county, fustian cutter, for improvements in machinery for cutting fustians and certain other fabrics, to produce a piled surface. Sealed 26th January—6 months for inrolment.

Thomas Berger, of Hackney, Gent., for improvements in the manufacture of starch. Sealed 26th January—6 months for inrolment.

CELESTIAL PHENOMENA for February, 1850.

D.	H.	M.	
1			Clock before the ☉ 13m. 54s.
	—		☽ rises 10h. 44m. A.
	—		☽ passes mer. 3h. 49m. M.
	—		☽ sets 9h. 55m. M.
3	9		♃'s second sat. will im.
	10	10	♃'s fourth sat. will im.
	13	53	♃'s fourth sat. will em.
	16	7	♃'s first sat. will im.
4	1	18	☽ in □ or last quarter
	17	48	☿ in conj. with Ceres, diff. of dec. 10. 38. N.
5			Clock before the ☉ 14m. 19s.
	—		☽ rises 2h. 5m. M.
	—		☽ passes mer. 6h. 56m. M.
	—		☽ sets 11h. 40m. M.
	10	35	♃'s first sat. will im.
6	16	19	☿ greatest hel. lat. N.
7	1	4	☿ in inf. conj. with the ☉
	6	41	Ceres in conj. with the ☉
8	3		☽ in Apogee
	19	5	☿ in conj. with ♀ diff. of dec. 5. 5. N.
9	21	23	♀ in Aphelion.
10			Clock before the ☉ 14m. 32s.
	—		☽ rises 6h. 24m. M.
	—		☽ passes mer. 10h. 52m M.
	—		☽ sets 3h. 24m. A.
	12		♃'s second sat. will im.
	18		♃'s first sat. will im.
11			☉ eclipsed, invis. at Greenwich
	9	29	♀ in conj. with the ☽ diff. of dec. 1. 45. S.
12	6	29	Ecliptic conj. or ● new moon
	12	28	♃'s first sat. will im.
14			Mercury R. A. 20h. 51m. dec. 14. 14. S.
	—		Venus R. A. 21h. 36m. dec. 15. 33. S.
	—		Mars R. A. 5h. 17m. dec. 26. 1. N.
	—		Vesta R. A. 6h. 55m. dec. 25. 35. N.
	—		Juno R. A. 13h. 45m. dec. 5. 9. S.
	—		Pallas R. A. 20h. 26m. dec. 2. 52. N.
	—		Ceres R. A. 21h. 44m. dec. 20. 53. S.
	—		Jupiter R. A. 11h. 28m. dec. 4. 56. N.
	—		Saturn R. A. 0h. 23m. dec. 0. 5. N.

D.	H.	M.	
14			Georg. R. A. 1h. 26m. dec. 8. 30. N.
	—		Mercury passes mer. 23h. 9m.
	—		Venus passes mer. Noon.
	—		Mars passes mer. 7h. 40m.
	—		Jupiter passes mer. 13h. 49m.
	—		Saturn passes mer. 2h. 46m.
	—		Georg. passes mer. 3h. 49m.
15			Clock before the ☉ 14m. 26s.
	—		☽ rises 8h. 45m. M.
	—		☽ passes mer. 2h. 42m. A.
	—		☽ sets 8h. 50m. A.
	3	16	♄ in conj. with the ☽ diff. of dec. 1. 22. N.
	10	53	♃'s third sat. will im.
16	5	49	♀ in conj. with Ceres, diff. of dec. 5. 57. S.
	10	22	♅ in conj. with the ☽ diff. of dec.
17	14	56	♃'s second sat. will im.
18			Juno stationary
19			Occul. 48 Tauri, im 12h. 10m. em. 13h. 4m.
	—		☿ stationary
	8	12	☽ in □ or first quarter.
	14	22	♃'s first sat. will im.
20			Clock before the ☉ 14m. 22s.
	—		☽ rises 11h. 8m. M.
	—		☽ passes mer. 6h. 52m. A.
	—		☽ sets 1h. 34m. M
	7	48	♃'s fourth sat. will em.
21	8	50	♃'s first sat. will im.
22	14	51	♃'s third sat. will im.
23	23		☽ in Perigee
24	17	32	♃'s second sat. will im.
25			Clock before the ☉ 13m. 20s.
	—		☽ rises 4h. 26m. A.
	—		☽ passes mer. 11h. 48m. A.
	—		☽ sets 6h. 21m. M.
	—		Occul. 45, Leonis, im. 16h. 28m. em. 17h 17m.
	—		Occul. p Leonis, im. 18h. 41m. em. 19h. 26m.
26			Occul. χ Leonis, im. 6h. 18m. em. 6h. 57m.
	0	1	Ecliptic oppo. or ○ full moon
27			Occul. 10 Virginis, im. 11h. 9m. em. 11h. 46m.
28			Pallas in Aphelion
	—		Vesta stationary

J. LEWTHWAITE, Rotherhithe.

THE

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CONJOINED SERIES.

No. CCXIX.

RECENT PATENTS.

To Edward Woods, *of Liverpool, in the county of Lancaster, civil engineer, for certain improvements in turn-tables.*—[Sealed 28th June, 1849.]

This invention has for its object the attaining great lightness and durability in the framework of turn-tables, and consists in constructing the skeleton framework of the top or revolving part of the turn-table in the manner shewn in Plate IV., wherein fig. 1, represents the plan of the under side of the revolving top; fig. 2, is a plan view, looking down upon the table (half of the platform being broken away, the better to shew the general construction of the turn-table); and fig. 3, is a sectional elevation of the same. In the plan view, fig. 1, M, N, O, is a circular horizontal bearing-ring, of malleable iron, of convenient section, serving as an exterior bond for the framework, and forming the medium through which that part of the pressure of the revolving top, and its superincumbent load, which is not sustained by the centre-pin or socket of the turn-table, is transmitted to the rollers;—the under surface of the ring being truly formed, and otherwise adapted to rest or traverse upon the rollers in the ordinary manner. The iron composing this ring may be rolled straight, in one or more pieces, of suitable section, length, and strength, and bent to the requisite curvature in the ordinary way of bending iron bars,—the ends being welded up, or firmly united by splicing and rivets, as is well understood. In order to render the ring circular and true in form after the ends are welded

up, the iron is heated red hot, and passed in that state between rollers, in the manner frequently adopted for rendering the tyre-bars of wheels truly circular. The surface which is to traverse upon the rollers may be turned up true in the lathe. The quality of the iron should be such as will permit of welding without difficulty.

B, B, and B^1, B^1, are two horizontal parallel bars, of malleable iron, of suitable strength, laid across and upon the ring. These are not only an essential part of the top frame, but also constitute a line of railway across the turn-table; for which latter purpose it is necessary that they should be laid at a distance from each other suitable to the gauge of the railway on which the turn-table is to be employed, and that their upper surfaces should be adapted for the wheels of carriages to run over them. These bars are supported by the exterior ring M, N, O, and are attached thereto by knees and bolts, or other analogous means, as shewn at *z*, *z*, *z*, *z*, fig. 1. The said bars B, B, and B^1, B^1, are also united firmly to other bars, as A, A, A^1, A^1, at their mutual points of crossing, as at *r*, *s*, *t*, and *u*,—these latter bars being themselves firmly attached, at their ends, to the ring, as at *x*, *x*, *x*, *x*. A, A, and A^1, A^1, are two cross bars, of malleable iron, laid across the ring at a suitable distance apart, below, and in a direction transverse to the afore-described bars B, B, and B^1, B^1, in order to afford support thereto, and to increase the general stiffness of the framework. The ends of the bars A, A, and A^1, A^1, are firmly attached to the ring by iron knees and bolts or rivets, or other equivalent means. Brackets for that purpose are shewn at *x*, *x*, *x*, *x*. The bars A, A, A^1, A^1, B, B, B^1, B^1, are firmly united together at their mutual places of crossing *r*, *s*, *t*, *u*, so as to enable the framework to resist more effectually the action of both horizontal and vertical pressures. It is preferred to connect them by uniting each bar separately, and in two places, to a common central frame F, F, F, F; although this particular mode of union is not absolutely essential. The bars A, A, A^1, A^1, have the same sectional form as the bars B, B, B^1, B^1; but this is not essential; as, in proportion that the bars B, B, B^1, B^1, are made stronger, the bars A, A, A^1, A^1, which give support thereto, and additional stiffness to the ring and support to the covering, may be made weaker; or one or even both might be dispensed with, in the event of the bars B, B, B^1, B^1, and the ring M, N, O, respectively, being made strong enough in themselves for the required work. The patentee, however, considers that, in practice, the greatest economy of materials, consistent with a given required strength and stiffness in the

entire top frame, and the greatest degree of durability, and the most convenient arrangement, are attained by making all the bars of similar section, and arranging the lower supporting bars as shewn in the drawing.

F, F, is an interior central frame of cast-iron, attached firmly to the bars A, A, A^1, A^1, and B, B, B^1, B^1, at their places of crossing. This central frame is provided with an adjustible centre-pin P, in the usual manner. The ends of the arms are suitably shaped to receive the bars. The lower bars A, A, A^1, A^1, rest on ledges *l*, *l*, fig. 1, and are perforated for screw-bolts, and screwed firmly up to a shoulder. The upper bars B, B, B^1, B^1, rest upon projecting brackets *m*, *m*, formed in the cross-frame F, F,—each bracket being shaped to receive the bar and a tightening wedge of dry wood, by which the bar is securely attached to the cross-frame, as an ordinary railway bar is to its chair: a bolt is also passed through the rail and bracket. The object of this frame is twofold; firstly, to transmit to the centre-pin any required portion of the weight of the revolving top frame and its superincumbent load,—thereby easing the load from the rollers; and, secondly, to confine the revolving top frame to a fixed centre of motion. This twofold object being common to most turn-tables, the patentee makes no claim thereto. As respects the interior cross-frame F, F, he does not confine himself either to the form thereof, the material of which it is composed, the mode of construction, or the mode of attaching the bars thereto; nor does he consider it absolutely necessary that it should be united directly to more than either the upper or the lower series of cross-rails, one or other of them,—it being merely required to fulfil the twofold object, above mentioned, in connection with the framework of malleable iron bars heretofore described.

T, T, is the covering or platform of the table, composed of planks, supported upon the upper surfaces of the malleable iron ring and lower cross-bars, and secured in their places by being bolted on to pieces of cast angle iron, secured to the ring. Iron plates might be adopted for the covering, but planks of timber are preferred, as offering less liability to fracture, greater facility to repair, producing less noise, and being better adapted for horses to work upon. If the top face of the rails B, B^1, is not high enough above the surface of the covering T, T, to allow the flanges of the wheels of carriages passing over the turn-table to clear the planking, care must be taken to leave grooves for the flanges to run in:

other lines of railway may (if required) be laid on the planking of the table, as is well understood.

The plan, fig. 2, is shewn as divided into two halves. The left-hand half shews the table in its complete state, with the covering-boards in their places. The right-hand half of the revolving top is removed, to exhibit the under-works, such as the supporting blocks of stone, the roller-path, the rollers, the roller-guides, and the centre socket. The left-hand half shews the mode of placing a second or cross-line of railway over the turn-table.

The sectional elevation, fig. 3, is taken through the centre of the turn-table. The arrangement of the foundations, external curb, roller-path, rollers, radial arms, centre block, socket, &c., present no special features of novelty, and their construction is familiar to practical men.

The patentee, in concluding his specification, remarks, that he is aware of it having been proposed, before the date of his patent, to employ a wrought-iron ring in the construction of turn-tables, in combination with radial spokes; also other arrangements and combinations of some of the parts above mentioned have been suggested; and this he mentions that he may not be supposed to claim the use of such parts, except when employed combined as above described. He claims, as his invention, the constructing the skeleton top or revolving part of turn-tables of a ring of malleable iron, as an external bond, resting on rollers, and firmly united to two of the lines of rails, and combined with an interior frame, turning on a centre, as above described.—[*Inrolled December*, 1849.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in stoves, grates, or fire-places, and in warming or heating buildings,—being a communication.* —[Sealed 5th June, 1849.]

This invention consists of various improvements in apparatus for warming or heating buildings or apartments; and relates, firstly, to an improved mode of constructing stoves, grates, or fire-places, intended to be used in place of the open grates or fire-places now ordinarily applied to private houses. The invention relates, secondly, to an improved mode of constructing and arranging apparatus for warming or heating buildings or apartments by means of hot water,—the advantages derivable therefrom being the maintenance of a more uniform tempera-

ture and a greater economy of fuel than by the ordinary hot-water apparatus. This improved apparatus admits also of being constructed and applied in a manner that will prevent disfigurement to private apartments, and may be adapted to any building without involving the necessity for great alterations, to admit of the passage of large water-pipes from one part of the building to another, as is now the case. The apparatus is also particularly applicable for warming hot-houses, conservatories, and large halls or apartments, which cannot be conveniently and effectually heated by an open fire-place; and, owing to the constant circulation of air through the apparatus, the warming of the apartment will be thoroughly effected, without the heat from the apparatus feeling at all oppressive, as is sometimes now the case with hot-water apparatus.

In Plate V., fig. 1, is a front elevation of one of the improved open fire-places, complete; fig. 2, is a transverse vertical section, taken in the line 1, 2, of fig. 1; fig. 3, is a front elevation, with the face-plate removed, to shew the internal arrangement of the parts; fig. 4, is a horizontal section, taken in the line 3, 4, of fig. 2; and fig. 5, is another horizontal section taken in the line 5, 6, of fig. 2. The grate-bars *a, a,* are not attached to the sides of the fire-place, but are supported on feet, which stand in the moveable ash-pit or pan *b, b.* The front bars *c, c,* are not fixtures, but are supported on hooks, attached to the sides of the fire-place,—so that, after simply lifting off the bars *c, c,* the ash-pit or pan *b, b,* and grate-bars *a, a,* may be removed together. The sides and back of the fire-place are lined with fire-bricks or tiles *d, d,* which, being bad conductors of heat, prevent it from being carried off too rapidly, and will very much increase the intensity of the fire. A chamber A, termed a smoke-consuming chamber, is formed by an inclined plate *e, e,* (figs. 2, and 4,) furnished with openings at each of the top corners, for the purpose of allowing the smoke and other gaseous products of combustion to enter the chamber, where they are consumed by the intense heat generated therein, assisted by the admission of a small quantity of hot air, which finds its way into the chamber with the smoke and gases. The incombustible gases pass off by the flue or pipe *f, f,* which must be properly proportioned to the other parts of the fire-place. The front part *g, g,* of the chamber A, forms a hood, projecting over the grate. In front of this hood a moveable screen or shutter *h, h,* is suspended by chains, which pass over pulleys *i, i,* (figs. 2, and 3,) above. The screen or shutter

h, h, is shewn detached at figs. 6, and consists of a light metal frame, in which a number of tubes, made of glass, are placed one upon another. The screen or shutter is capable of sliding in guides, as shewn at figs. 2, and 3; and it is counterbalanced by the weights *j, j,* attached to the ends of its supporting chains, which pass over pulleys *i, i,* as shewn at fig. 3. A ring, stud, or hook *r,* is fixed at the lower end of the shutter *h,* for the purpose of raising and lowering the same. It will be seen, on referring to figs. 2, 3, 4, and 5, that the fire-place, stove, or grate, together with the smoke-consuming chamber A, are enclosed in or surrounded by a metal casing *k, k,* which forms a kind of hot-air chamber, or rather chamber or space for warming air that is admitted, either from the apartment or the external atmosphere, through holes made at or near the lower part of the casing, as at B, B, fig. 1, or at any other convenient part; and, after passing over or in contact with the heated surfaces of the said chamber, the air will issue, in a heated state, into the room or apartment, through holes or openings made at the upper part of the casing, as at C, C, C. It is almost unnecessary to remark that these openings or holes B, B, and C, C, C, in the front of the stove or grate, may be hidden from view, if desired, by covering them with any open-work ornament, which will allow a free passage to the air. The horizontal pipe *l,* in the chamber A, communicates at each end with the hot-air chamber, and is only intended to give an increased amount of heating surface, by exposing its outer side to the action of the highly heated gases in the chamber A: it may, however, be dispensed with, if preferred.

From the foregoing description it will be evident that the combustion and the intensity of the fire may be regulated at pleasure, by simply raising or lowering the moveable transparent screen or shutter *h.* For instance, when the screen is up the fire will burn slowly; and when it is lowered a little the opening for the admission of air to the fire will be lessened, and the combustion will consequently be quickened; but when the screen is let down to its lowest position, the fire will burn with great intensity, as the rush of air to the fuel will be very considerable.

The patentee remarks that he sometimes constructs the transparent screen or shutter of wire gauze instead of glass tubes. This kind of screen he employs when the chimney is badly constructed and liable to smoke; as the metallic gauze will allow a considerable portion of heat to pass through when the screen is down, and at the same time will admit of air passing in the contrary direction to the fire.

Fig. 7, shews a transverse vertical section of a modification of the above arrangement,—the principle being applied, in this instance, to a stove, which may be detached from a wall or chimney, and placed in any convenient part of the apartment. In this instance, the pipe *l*, is dispensed with, and the flue-pipe *f*, is carried out through the back of the warm-air chamber, instead of from the top of the chamber A, as at figs. 1, 2, and 3.

Another modification is shewn at fig. 7*, which also represents a transverse vertical section of a stove. In this instance the inclined plate *e*, which forms the bottom of the smoke-consuming chamber, is dispensed with,—the chamber A, being left open, and the gases contained therein being thereby exposed to the direct and most intense action of the fire in the grate. The flue-pipe *f*, is also, in this case, carried out from the back of the smoke-consuming chamber A. The mode of conducting off the incombustible gases must, however, depend upon circumstances, such as the situation of the stove, and will in no way alter or interfere with the principle upon which the stove is to be constructed.

If thought desirable, air from the external atmosphere may be conducted by a pipe to the lower part of the casing *k*, *k*; and, after being warmed therein, allowed to issue into the room: by this means a constant current of pure warm air will be supplied to the apartment. The patentee remarks that, by making the ash-pit *b*, *b*, and the grate-bars *a*, *a*, removeable, they may be carried away with the dust, ashes, and cinders contained therein, and cleaned, without occasioning any dust or dirt in the apartment.

As it has been found of importance, in carrying out the above improvements, to retain certain relative proportions between some of the parts, the inventor gives the following as the result of his experience:—For a fire-place in which the grate-bars have a superficial area of about 10 inches by 16 or 17, and which has an opening in front, represented by the screen or shutter *h*, of about 17 inches square, the flue *f*, should be about 5 inches in diameter; and for a fire-place or grate with a superficial area of grate-bars measuring 7 inches by 10, and having a front opening of 14 inches by 10, the flue *f*, should be about 4 inches in diameter.

The improvements in hot-water apparatus, for warming and heating buildings or apartments, which form the second part of the present invention, consist in a peculiar construction and arrangement of hot-water pipes, in which a continued circulation of hot water is kept up, by causing hot water from

a boiler to enter the heating-pipes (which are annular in their section), and the cold water to leave the same, at or near the lowest point of each pipe or set of pipes: cold air also passes through the centre of the heated pipes, and issues out into the room at an agreeable temperature.

The tubular part of the apparatus consists, first, of a service-pipe or tube, of moderate size, for conveying the hot water from the boiler to the apparatus for warming the air; secondly, of another pipe, of the same dimensions, for carrying the cooled water back to the boiler to be again heated; and, thirdly, of the heating apparatus, properly so called, which consists of a series of warming-pipes, or hot-water chambers, connected at their lowest part to the two service-pipes, which bring the hot water to, and conduct the cold water from, the heating-pipes or apparatus.

The inventor, in order to shew the distinctive features of this part of his invention, remarks that, in the plans for heating by hot water, which have heretofore been adopted, two tubes are employed,—the one leading from the boiler, and the other to it—the intermediate length of tube being arranged in some peculiar manner for warming the apartment in which the apparatus is placed. Or these two tubes may be considered as a continuation of one tube, extending from the boiler throughout the house or place to be heated, and terminating at the other end in the boiler again; whereas, the present improved apparatus consists, first, of a service-pipe, of small diameter, extending, as heretofore, from the boiler throughout the house, and returning again to the boiler,—such service-pipe being intended merely to convey the hot water to and from the boiler, and not to act as a heating-pipe, as heretofore. To this service-pipe a distinct apparatus, consisting of an arrangement of heating-pipes, is connected by short branch-pipes; and any number of these apparatus may, in this manner, be connected with or attached to the service-pipe, at suitable places, for the purpose of warming rooms or apartments. In place of causing the hot water from the service-pipe to flow into the heating-pipes or apparatus at or near the top, and drawing off the cold water at bottom, as has been heretofore the case, the hot water is introduced at bottom, and by its superior lightness it will quickly rise to the top and displace the cold water, which will flow out at the bottom. By thus opening a communication between the heating apparatus and hot-water service-pipes at two points, at or near the bottom, and allowing the hot water to flow into the apparatus, a continued circulation will be maintained in

each set of heating apparatus; but this circulation may, however, by means of cocks, be regulated at pleasure, or arrested altogether, without interfering with the action of any other set of pipes or heating apparatus, or the circulation of hot water in the service-pipes.

By referring to the sectional diagrams, figs. 8*, and 9*, the essential difference between the two systems of heating by hot water will be readily seen. Fig. 8*, represents the old system, in which the heating apparatus is supposed to consist of a hollow cylinder, with an annular water space,—the air being allowed to pass through the cylinder, in contact with the heated sides, and thereby become warmed. The hot-water service-pipe *g,* enters the cylinder near the top; and the pipe *h,* which carries off the cold water to the boiler, communicates with the cylinder at the bottom. Now, the defect of this arrangement is, that in the event of air or steam entering the cylinder from the service-pipe *g,* it would remain at the upper end of the cylinder and stop the circulation, not only in the heating-cylinder, but also in the return service-pipe *h,* and, consequently, stop the action of any other apparatus on the service-pipe. In fig. 9*, however, the hot-water service-pipe *g,* communicates with the cylinder by means of a short branch-pipe at the lower end thereof, so that the hot water, by rising in the cylinder, displaces the cold, which flows down a similar branch-pipe into the return part *h,* of the service-pipe. It will therefore be evident that no accumulation of air or steam, at the upper end of the cylinder, can affect the circulation, even in the cylinder itself; and if the cylinder should become entirely filled with air or steam, the circulation through the service-pipe would still continue uninterrupted.

The mode of applying this improvement will be understood from the following description:—Fig. 8, is a sectional elevation in partial side view of the heating apparatus, constructed, as before mentioned, of pairs of concentric tubes, with an annular water-space between them. These tubes, and all others connected with the apparatus, the inventor prefers to construct of thin sheet-copper.

Fig. 9, is a sectional representation of a house, fitted up with the improved hot-water apparatus complete. The boiler, in which the water is heated, is supposed to be in the basement story, and is shewn at B;—its construction and operation will be hereafter described. The service-pipe *g,* conveys the heated water from the boiler to the tubular heating apparatus H, fig. 9; one of which apparatus, consisting of three or any convenient number of heating pipes or columns, is placed

under each window: that being the coldest part of the room. The service-pipe *g*, is continued up to the floor above, where other sets of heating apparatus, similarly arranged, are provided; and if there are no heating apparatus above this floor, the service-pipe *g*, is carried into the return or cold-water service-pipe *h*, which communicates, at its upper end, with a cold-water reservoir R, in the attic or roof of the house, and its other end passes down to the basement story, where it enters the lower part of the water-chamber of the boiler. At fig. 8, (which shews the heating apparatus upon an enlarged scale) *g*, is the pipe for conducting the hot water from the boiler to the heating apparatus,—the current being supposed to circulate through the apparatus in the direction of the arrows. In this case, the heating pipes or columns, as they are termed, are placed horizontally, and consist of two thin concentric copper tubes 1, 2, soldered or otherwise fastened together at their ends, so as to form an annular water space 3, and a hollow space 4, for the free passage of air through the inner tube. These tubes, so constructed, may be arranged either side by side on a horizontal plane, or one above the other, as shewn in the drawing; and they must be made to communicate with each other at both ends by means of short branch-pipes *g**, and *h**. The upper pipe of every set of heating pipes is provided with a small cock or screw-plug *i*, which can be easily opened or removed, for the purpose of allowing air to escape therefrom when the pipes are being filled with water. The operation of the apparatus is as follows:—The cocks or screw-plugs *i*, *i*, of all the heating pipes are opened, in order to allow the cold water from the reservoir R, above (see fig. 9,) to flow into and completely fill the pipes or columns of the heating apparatus, as well as the boiler B, below, and the supply-pipes *g*, and *h*. When water begins to flow from the cocks or plugs *i*, it will indicate that the pipes of the heating apparatus are full; and the cocks or plugs *i*, must then be closed. Then, upon heating the water in the boiler B, the hot water will, by its less specific gravity, rise up the supply-pipe *g*, and pass along its horizontal branches to the heating pipes or columns, where it will meet with a body of cold water, which, by its lightness, the hot water will displace,—causing the cold water to descend and occupy its place in the pipe *g*, or its branches. It is this tendency of the hot water to rise and the cold to descend (or, in other words, of the hot water to displace the cold which runs into the boiler below, in order to restore the equilibrium there destroyed by the heat of the fire) which causes the rapid circulation; and it is this rapid circulation of hot water through-

out the entire series of pipes (however extensive it may be) on which the successful operation of the apparatus depends. The branch supply or service-pipe *g**, of every set of pipes, or separate heating apparatus, is furnished with a stop-cock s, shewn in the detached sectional view at fig. 10. This cock consists of a plug *p*, with a hole through the middle coincident with the bore of the hot-water pipe *g*, on which the cock is placed; the plug *p*, works in a cylindrical recess or chamber made in the barrel of the cock, and is kept in its place by the plate *q*, which is screwed on to the under side of the barrel; and the spindle of the plug passes through a circular hole in the top of the barrel, and is made square at the end, so as to receive a key, by which it is turned. The cock is made steam and water-tight at its upper side by collars or packing *r*, screwed down on to the barrel by the screw-cap *t*. By means of this cock, the circulation of hot water in the apparatus, to which it belongs, may be either partially or completely arrested; and the water contained therein will, in the event of the communication being entirely cut off, remain cold, although the short branch-pipes *h**, of the apparatus, and the hot-water supply-pipe *g*, will still communicate with each other. It will therefore be evident that, when the apparatus is in action, any room or apartment in the house can be warmed by merely turning the cock s, and allowing the warm water to circulate through the pipes or columns of the heating apparatus H, fig. 9; and, on the other hand, the temperature may be reduced by lessening or arresting the circulation altogether, by means of the cock s, in the manner already mentioned.

Fig. 11, represents a sectional plan view, and fig. 12, an elevation, of a set of vertical pipes, enclosed within a perforated metal or other casing, and which may be placed in any convenient part of the apartment. The construction and operation of this apparatus will be easily understood on reference to the drawing; and, therefore, after the detailed description just given of the other figures, needs no further explanation.

The patentee remarks that, in order to avoid complexity in the drawing, the heating pipes or columns are not shewn at fig. 9, as enclosed within casing, as they would be when used for warming sitting rooms: the supply-pipes *g*, and *h*, being of but small diameter, can be easily hidden from view by a skirting-board, or an ornamental moulding, when they pass up one corner of the room.

It has been stated that the above apparatus may be supplied with hot water from any suitable boiler; but, in order to ren-

der the apparatus for warming buildings by means of hot water as complete as possible, the inventor prefers to employ the improved construction of boiler shewn in longitudinal vertical section at fig. 13. It consists principally of a long vertical annular-shaped water-chamber or case A, A, made of sheet-copper, or iron, if preferred, and surrounded with a layer of sand, or other bad conductor of heat,—the whole being enclosed within masonry or brickwork, which will further prevent any considerable waste of caloric by radiation. The furnace or fire-place is below,—*a*, *a*, being the grate or fire-bars, for supporting the fuel, and *b*, *b*, the ash-pit. The fuel is supplied to the apparatus through a feed-pipe B, above, furnished with a suitable door or opening, as shewn in the drawing. The fuel, when supplied through this feed-pipe, falls into a long hollow vertical chamber, consisting of two parts D, and E;—the part D, is a portion of a long hollow cone, and is attached at the upper end to, and is suspended from, and supported by, a strong moveable metal frame or ring C; and to the lower end of the part D, a second conical chamber E, is attached, so as to form a kind of prolongation of the part D,—the only difference being that the base of the cone E, widens out more rapidly than the long cone D, and forms a kind of wide mouth to the former. The long conical chamber D, E, may be called the fuel-chamber; and, when the apparatus is in operation, it should be filled with fuel through the pipe B. The flue, through which the smoke and combustible gases given off from the fuel rise, is seen at F;—it surrounds the fuel-chamber D, E; and the gases, being burnt or consumed therein, generate a great heat, which is communicated to the water in the annular boiler or water-case A, A. This water-case is supplied, by the pipe H, below, with the cold or cool water, from which the caloric has been abstracted in the heating pipes or columns above described, or from the reservoir R, fig. 9; and the hot water, by being lighter than the cold, rises and passes out through the pipe G, above, to the supply-pipe *g*, of the heating apparatus. The size of the fire, and, consequently, the quantity of heat transmitted to the water, is regulated by raising or lowering the fuel-chamber D, E, which is effected in the following manner:—It has been already stated that this chamber is suspended from a frame or ring C;—this frame or ring is furnished with two vertical arms *c*, *c*, which pass through holes made in the sheet-iron covering I, I, and are attached, at their upper ends, to a cross head J, through the centre of which a strong and powerful screw K, passes,—its fixed bearing being on the top of the metal cover I, of the apparatus. By turning the screw K, the

fuel-chamber D, E, may be raised or lowered at pleasure, and a greater or less quantity of fuel submitted to the action of the fire. Owing to the length of, and great heat engendered in, the flue F, all the smoke and combustible gases will be effectually consumed, and no useful product of combustion, and but little heat, will pass out through the exit-pipe L, to the chimney.

The patentee claims, First,—the employment of a moveable transparent shield, guard, or screen, made of glass or metallic gauze, and arranged or adapted to the fire-place or grate, in such a manner that it may be wholly or partially opened or closed with facility (when required to regulate the intensity of the fire and heat given out), and thereby increase or diminish the front opening for the admission of air to act on the fuel in the fire-place. Also the low-placed fire-grate, recessed back (as shewn), and surrounded with fire-brick, in combination with the overhanging hood, for the purpose of preventing the emission of smoke or gases into the apartment, and generating a great heat for consuming the smoke and combustible gases in the smoke space or chamber. And, further, the combination of the overhanging hood and smoke-chamber with the hollow casing or chamber which surrounds the grate, and into which the air is admitted and allowed to circulate, for the purpose of being heated or warmed before issuing into the apartment through holes made in the front part or jambs of the grate or fire-place. Secondly,—the combination of the horizontal or vertical heating-pipes or columns of the hot-water apparatus with the smaller supply or service-pipes *g*, and *h*, whereby the water is conveyed to and from the heating-pipes or columns;—the essential feature of such arrangement or combination being, that the heating-pipes, or columns, or apparatus, or each set or series composed of more than one pipe or column, shall communicate at two places, at or near their lower ends, with the hot-water pipes; so that a continued circulation of water may be kept up in the service-pipes, and also in the heating apparatus; and which circulation may be partially or wholly arrested in any set of heating-pipes, columns, or apparatus, without interfering with the other heating-pipes or the circulation of hot water in the service-pipes. Thirdly,—the construction of the boiler or apparatus shewn at fig. 13, and the application thereof for heating water for the above-mentioned purposes; such apparatus consisting of a long vertical fuel-chamber D, E, with the fire-place below, and the flue surrounding the fuel-chamber; the flue and fuel-chamber being enclosed by a long annular water-space.—[*Inrolled December*, 1849.]

To Henry Trewhitt, *of Sunbury-park, in the county of Middlesex, Esq., and* Thomas Russell Crampton, *of Buckingham-street, in the City of Westminster, civil engineer, for improvements in locomotive, marine, and stationary engines; and also in the connecting apparatus of marine engines.*—[Sealed 2nd June, 1849.]

This invention consists, firstly, in arranging a locomotive engine in such a manner that the driving-wheel axle is placed behind the fire-box and under the coke-box, which, together with the water-tank, is supported on one frame with the boiler. This arrangement is shewn in Plate VI., at figs. 1, and 2, in which A, is an ordinary horizontal tubular boiler; B, is the driving-wheel axle, placed behind the fire-box; and C, is the water-tank, placed between the fire-box D, and the axle of the small wheels E. This tank (see fig. 2,) is made as wide as possible by the absence of all machinery underneath the boiler,—the cylinders, feed-pumps, excentrics, &c. (see fig. 1,) being outside. F, is a coke-box, placed over the fire-box, with holes *f*, (see fig. 2,) cut in the plate, of a convenient height for the man to use his shovel when he requires to withdraw the coke for feeding the fire. The drawing shews only two pairs of wheels; but any other number may be used.

Under this head the patentees claim placing the driving-wheel axle behind the fire-box, in combination with the water-tank and coke-box on one frame with the horizontal tubular boiler.

The second improvement consists in so arranging the springs of locomotive engines that the weight of the boiler, &c., suspended from the rails, rests or articulates on three points,—thereby causing a more uniform weight to be maintained on the rails. One mode of accomplishing this object will be seen by referring to fig. 4. In this figure the ends A, A, of a transverse spring rest respectively on a driving-wheel axle-box; and the weight of the boiler is taken by the centre B, of this transverse spring and transferred at all times nearly equally through both driving wheels to the rails. The front spring C, (fig. 3,) is shewn reaching from centre to centre of the small wheels D, D, and its ends have an ordinary communication to each axle-box *d, d,* of the small wheels. The centre E, of this spring is attached to the frame of the engine in such a manner that it acts as a pivot for it to turn or articulate on; so that, in the event of one wheel being lifted or depressed by the inequalities of the road, or from any other cause, each wheel D, D, receives the amount of weight it is designed to

carry. It will be understood that a similar pair of wheels and springs are provided at the other side of the engine, having a similar action to that just described. It will be clear, therefore, that the boiler, &c., or suspended portion of the engine, rests or articulates on the three points, having always springs for medium; namely, one B, on the centre of the transverse spring, over the driving-wheel axle, which is placed on the extreme end of the fire-box; another E, on the centre of the longitudinal spring, which spring reaches from centre to centre of the small wheels; and the third, corresponding with E, on the opposite side of the engine. Although the driving-wheels of the engine are shewn at the end of the fire-box (that being the position which the patentees prefer), with the cylinders projecting beyond the extreme front wheels, and connected to the driving wheels, as hereinafter described, yet they do not limit themselves to this precise arrangement (such, for instance, as number or disposition of wheels or springs), so long as the boiler, or suspended portion of the machine, rests or articulates on three points, having springs for medium. The cylinders can be placed immediately behind the small wheels, or over them,—the power being communicated direct to the driving wheels, or by any other method that may be thought proper.

The third improvement is shewn at fig. 3, and consists in placing the axle F, of the driving-wheels G, at the end of the fire-box of a locomotive engine;—the power being communicated from the cylinders H, first by a connecting-rod I, to a crank K, fixed by any well-known means to a revolving shaft L, (the bearings of which are secured to the frame of the machine) and from thence to the driving-wheels G, by coupling-rods M: this system may be used in combination with the arrangements of springs and wheels, as before described. Although it is preferred to mount the excentrics on the revolving shaft L, yet the general detail may be made according to circumstances, so long as the principal features of this improvement are retained, viz., the placing the driving-wheel axle behind the fire-box, and forming a communication to it from a revolving shaft, which shaft is propelled or turned round by any ordinary means.

The fourth improvement is shewn at figs. 3, and 4, and consists in forming the boilers of locomotive engines in such a manner that the top of the fire-box is stayed to the outer shell of the fire-box in a similar way to the sides of ordinary fire-boxes;—care being taken that a steam space be left above the water. This is effected in the following manner:—It

will be seen, on referring to fig. 4, that, instead of curving the whole of the top of the outer shell of the fire-box, as in ordinary boilers, a portion of the top N, is made flat and parallel with the inner fire-box O, carrying it forward until it reaches the cylindrical portion of the boiler *l*, (fig. 3,) when it is turned up and secured, by the ordinary means, to the barrel of the boiler;—these two plates N, and O, being parallel, straight stays Q, Q, Q, at proper distances apart, are passed through both, and secured to each plate in the ordinary manner, similar to those shewn at the sides R, R, fig. 4. It will be seen, that the flat top N, fig. 4, commences nearly at the point where the first upright stay *r*, would cut through the outer curve *n*, if carried on; and this curved portion commences at the first lateral stay *p*: it will also be observed, that there is room left for the steam above the water. The peculiar feature of this improvement consists in securing the top of the fire-box to the outer shell in the ordinary manner of staying the sides of fire-boxes of locomotive engines;—care being taken to have as much steam room as convenient above the water: the form may be varied from that shewn in the drawing if found convenient.

The fifth improvement consists in combining the parts of a locomotive engine in such a manner that the driving-wheel axle is placed under the front end of a horizontal tubular boiler, and driving or turning the axle by a coupling-rod, which coupling-rod is worked by a revolving shaft, secured to the framing. The mode of effecting this combination is shewn at figs. 5, and 6. A, is an ordinary horizontal tubular boiler; and B, is the axle of the driving-wheels, placed under the front end of the boiler;—the power being communicated from the cylinder C, through a connecting-rod D, to a crank K, on a revolving shaft E, (the bearings of which are secured to the frame of the machine) and from thence to the driving axle B, by a coupling-rod F. One or two pairs of small wheels, as shewn at fig. 5, may be used to carry the fire-box end of the boiler, as desired. The cylinders may be placed in any other convenient position.

The patentees claim the use of the horizontal tubular boiler in combination with the axle of the driving-wheel under the front end of it;—the driving-wheels to be worked or turned round as described.

The sixth improvement consists in arranging the connecting or disconnecting apparatus of marine engines, whether for driving paddle-wheels or any other propeller, so that when two surfaces are brought together, the power of the engine,

when propelling forward, presses these surfaces firmer together. Fig. 7, is a partial section, shewing one mode of carrying out this improvement. A, is the crank-shaft, near to one end of which a left-handed screw B, is cut; and a large nut or circular disc C, fits or screws on to this shaft: holes *d, d*, are made in the disc, for the purpose of screwing it up. D, is a crank, fitted on to the shaft A, so that it may turn easily upon it, and is prevented from going too far by a large collar E. The boss of the crank D, is made to correspond in diameter to the disc or nut C; and between the surfaces of the disc or nut C, and the crank D, a thin circular washer G, is placed. F, is a key, passed through the shaft A, to prevent the crank from turning without the shaft, on reversing the engine to go astern. The operation at starting will be as follows:—Suppose the surfaces of the collar E, crank D, washer G, disc C, and key F, to be brought close together, it will be seen that when the crank D, is propelled forward it tends to carry the disc C, with it; and the pressure acting on the left-handed screw B, of the shaft, the action is—to more firmly bring the disc and crank together, and consequently to bind them more securely. If the key F, be firmly fixed in its place, it will be clear that, upon reversing the crank-motion, the whole will revolve together; but when it is required that the crank should revolve on the shaft, the key F, must be driven back, giving, say, one-sixteenth of an inch play between it and the disc C; the disc or nut may then be unscrewed by hand, or it may be unscrewed by reversing the engine; and the result will be that the crank D, will be at liberty to revolve on the end of the shaft A, and the disconnection will be consequently effected. The detail of this arrangement will have to be varied according to circumstances.

The patentees claim arranging the connecting or disconnecting apparatus of marine engines in such a manner that, when flat surfaces or discs are brought together, the action of the propelling force, when moving in the forward direction, has the tendency of more firmly uniting them.

The seventh improvement consists in applying the beforementioned connecting or disconnecting apparatus to stationary engines when required.

The eighth improvement consists in counter-balancing the unbalanced parts of screw-propeller engines, or other marine engines travelling at great velocities. This is effected by fixing weights opposite the unbalanced portions of the engine, such as the crank, &c., which weights should revolve as nearly as convenient in the same plane as the parts to be counter-

balanced;—their ponderosity is to be determined after the ordinary way of equalizing weights.

The patentees claim the counter-balancing of marine engines, as before described.—[*Inrolled December*, 1849.]

To Samuel Colt, *of Trafalgar-square, in the county of Middlesex, Gent., for improvements in fire-arms.*—[Sealed 20th June, 1849.]

This invention of improvements in fire-arms consists in certain improvements upon that construction of guns and pistols which has a cylindrical revolving breech-piece, provided with a series of parallel chambers for containing a series of charges, which charges, by the revolution of the breech upon its shaft, may be successively brought into a line with the bore of the barrel, and be severally discharged through the same.

In Plate IV., the improvements constituting the present invention are shewn as applied to this construction of fire-arms, which formed the subject of a patent granted to the present patentee on the 22nd of October, 1835.

Fig. 1, shews a pistol made according to this invention; fig. 2, is a side view, shewing the lock-frame, and recoil-shield in section; and fig. 3, is a longitudinal section, taken through the middle of the breech and barrel. *a*, is the breech, containing six chambers (as shewn in the end view, fig. 4,); in the back of each of which a nipple is fitted (as shewn in end view at fig. 5, and in section at fig. 3,) to receive a percussion cap for firing the charge. This breech is supported by and is capable of turning on a spindle or arbor *b*, which is welded or fastened to and forms one piece with the recoil-shield *c**,—it being in a line parallel to the axis of the barrel. The shield is itself a continuation of the lock-frame *c*,—the whole being formed out of one solid piece of metal. By referring to the longitudinal section, figs. 2, and 3, and to the cross section, fig. 6, the peculiar construction of this lock-frame and shield will be readily understood. The shield *c**, stands up at right angles to the frame *c*, and forms a round head (somewhat like a bolt-head) to its shaft *b*. The upper part of the shield is recessed to receive the hammer *d*, when it is thrown forward to effect the discharge of the pistol; and a recess is also made in the piece of metal which constitutes the lock-frame and shield (see fig. 2,) to receive the parts which respectively revolve the breech to bring round the

charges in a line with the barrel *e,* and lock the breech to the frame, for the purpose of insuring that the charges shall be in a line with the barrel before the firing takes place. When the pistol is on half-cock, or in the position shewn at fig. 3, the breech is free to turn round on its arbor in the direction of the arrow, figs. 1, and 2. It may then be loaded and primed with facility, without being removed from its place, as was formerly requisite in charging this construction of revolving-breech fire-arms;—a free space being left in front of the mouths of the chambers, as will be seen by referring to the end view of this breech, fig. 4, which shews the sectional area of the barrel and its appendages in dotted lines. The barrel *e,* is supported in its place by the end of the spindle *b,* fitting into a socket in a bracket-piece, forming one piece with the barrel, as shewn best at fig. 3. Against the end of this socket the spindle is made to abut, and thus to determine the exact position of the barrel with respect to the face of the revolving breech. To keep the barrel secure in its place, a key *f,* is introduced through slots in the bracket or projecting piece of the barrel, and through the spindle *b;* its upper edge acting on the forward end of the slot in the spindle, and its lower edge acting upon the lower end of the slots in the bracket of the barrel; the effect of which is to draw the barrel towards the cylinder breech and lock-frame as the key is pressed in; and pins, projecting from the end of the lock-frame, enter corresponding recesses in the bracket-piece of the barrel. The key *f,* has a spring-catch, which rises when the key is forced "home;" and, by its turned-up end coming in contact with the edge of the slot through which it has been passed, it will prevent the key from getting loose and shaking out of its place by the concussion of the firing. This object is further ensured by the insertion, in the barrel-piece, of the screw 1; the head of which would come in contact with the turned-up end of the catch, if it had escaped past the edge of the slot, and prevent it from dropping, or even being drawn out: this screw must therefore be removed before the key can be displaced. Jointed to the bracket part of the barrel, by a pin 2, is a lever *g,* which is kept up in a position parallel to the barrel by a spring-catch at its other end taking into a catch on the lower side of the barrel. To this lever a plunger *h,* is connected by a pin 3, taking into a slot on the outer end of the plunger. The inner end of the plunger slides in a guide made for it in the bracket-piece of the barrel. This plunger is intended to act as a ramrod, and to drive the bullets or cartridges into the several chambers of

the breech, consecutively as they are brought in a line with the plunger.

To effect this, the catch of the lever *g*, is disengaged, and the lever is brought into the position shewn by dots in fig. 2; the plunger is thereby driven forwards and made to ram the bullet (which has been previously inserted in the end of the chamber, now brought in a line with the plunger) down into its proper place in the chamber; the plunger is then drawn back, and the next succeeding chamber brought in a line therewith, when the lever *g*, is again brought into the dotted position, to thrust the plunger forward and ram down another charge; and thus successively all the charges are acted upon. By referring to the drawing, fig. 3, it will be seen that the mouths of the chambers and the inner end of the barrel are chamfered at their edges. This bevilling of the edges of the chambers is to prevent the lateral discharge between the breech and the barrel (which discharge is consequent upon the construction of fire-arms to which these improvements refer) from igniting the powder in the other loaded chambers; for the ignited matter, by coming into contact with the bevilled edge as it crosses the mouths of the chambers, will be deflected outward and effectually thrown off, and be prevented from reaching the powder in the chambers. The bevilling of the end of the barrel is intended to prevent its cutting the ball in its passage from the chamber. At figs. 6, and 7, it will be seen that a hollow is made in one side of the shield *c**: the object of this is to expose the ends of the nipples as the breech is revolved, and thus to allow of the percussion caps being readily placed thereon. The hammer *a*, turns on a pin 4, in the lock-frame *c*; and it is provided with stops or catches for the end of the trigger to abut against, as usual, and hold it at whole or half-cock, as required. To the hammer is jointed a hand-catch *i*, with the spring *k*, attached (see fig. 2,), which is pressed forward into contact with ratchet-teeth formed on the end of the breech, and allows the hand-catch to recede for passing below a second tooth of the ratchet. *l*, is a rocking lever, supported by a pin in the lock-frame *c*, and carrying at one end a bolt, which is intended to enter, at certain times, into the recesses 5, 5, in the periphery of the breech;—a bearing-spring *m*, (see fig. 3,) giving it always a tendency to rise for that purpose. The other end of this lever is made thin, so as to be capable of yielding laterally and recovering its position; thus allowing a stud 6, (which projects from the hammer and has a chamfered or bevilled face) to pass the lever without disturbing the position of the

bolt-end when the hammer moves forward to fire the charge; and yet, when the hammer is drawn back, to present an obstruction to the stud 6, and be thereby tipped into the position shewn at fig. 3; which movement will unlock the breech. As long as the hammer remains at half-cock, the breech will be free to turn upon its spindle for the purpose of being loaded; but when the stud has passed the end of the lever, the spring *m*, will again force the bolt of the lever into its original or locking position. The action of drawing back the hammer to its farthest extent (the bolt being first relieved) will raise the hand-catch *i*, which, being brought in contact with a ratchet-tooth on the breech, will turn the breech round in the direction of the arrow, fig. 2, to the extent of one tooth, and thus bring up a loaded chamber in a line with the barrel; and, in succession, the act of cocking will bring all the loaded chambers, in like manner, round in a line with the barrel and hammer, to be discharged. In order to insure the insertion of the bolt of the lever *l*, into the recesses 5, 5, as they severally come round, and thereby to hold the breech firmly while the discharge takes place,—a shallow channel or guide is formed up to the edge of each, as shewn in the drawings, which will make the bolt feel its way to the recess and enter it more certainly than if it were required to fall into the recess suddenly. To prevent the fouling of the spindle and breech, a helical groove is formed upon the spindle, as shewn at fig. 3; the edges of which will more effectually prevent the smoke from passing between the breech and spindle than if the whole periphery of the spindle were in contact with the breech; and, at the same time, these edges will, as the breech is rotated, scrape off any matters that may have become deposited in the central bore of the breech and deposit it in the grooves. By this means the contact surfaces will be kept clean, and the breech, which would otherwise foul after a few discharges and become fixed, will be free to turn on its spindle, for a long period, without requiring any cleaning.

Fig. 8, represents in side view, and fig. 9, in plan view, a rifle, carbine, musket, or shot-gun, with revolving breech. As the several improvements before described, with reference to the pistol, are equally applicable to guns for military and sporting purposes, the patentee gives merely a description of the modified arrangement of apparatus for ramming down the charges, as represented at figs. 8, and 9. In this instance, instead of the plunger being applied below the barrel, it is attached to the side thereof. *a*, is a bracket, projecting from the side of the barrel; and to it the lever *b*, is jointed by a

pin 1. *c*, is the plunger, having, at about the middle of its length, a joint 2; it is forked at one end, and embraces the lever *b*, to which it is jointed by a pin 3; and the cylindrical end of the plunger works between guide-pins 4, 4, on the barrel. *d*, is a spring-catch, rivetted to the plunger *c*, and capable, when the lever *b*, is laid parallel with the barrel, of taking into a notch cut in the bracket *a*. By means of this spring the ramming apparatus, when not required to be used, is retained in the position shewn at fig. 8; but, by drawing the lever *b*, into the position shewn at fig. 9, the catch will be immediately disengaged from the notch.

The patentee claims, First,—making the lock-frame and recoil-shield in one and the same piece; whereby all possibility of the parts getting loose after repeated discharges is prevented. Secondly,—the general arrangement of the lock and apparatus for turning and locking the rotating cylinder-breech. Thirdly,—the general arrangement of the parts, whereby the operations of loading and priming may be effected without disconnecting the breech, as was heretofore requisite. Fourthly,—the application to guns and pistols of the lever apparatus for ramming down the charges into the several chambers with great expedition and effect,—the same being a substitute for the loose ramrod. Fifthly,—the chamfering the mouths of the chambers and the inner end of the barrel; also the grooving of the periphery of the breech-spindle; likewise the making sunk-guides to the locking recesses on the periphery of the breech; and, further, the means of ensuring the proper position of the barrel with respect to the face of the breech;—all for the purposes hereinbefore described.—[*Inrolled December*, 1849.]

To JOHN BROWNE, *of Great Portland-street, Portland-place, in the county of Middlesex, Esq., for improvements in apparatus to assist combustion in stoves or grates.*—[Sealed 4th July, 1849.]

THIS invention consists in the application of a hollow perforated apparatus or instrument to stoves or grates, to produce a hollow or space within the fire in such stoves or grates, and, by obtaining a draft or upward current, to improve the fire.

In Plate VI., fig. 1, is a back view, fig. 2, is a front view, and fig. 3, is a vertical section of the apparatus: fig. 4, exhibits it in use within a fire-grate. Numerous openings are made in the apparatus, and it is open at the top; so that,

when it is in its proper position, in the centre of the grate, a draft or upward current through it will be obtained, and the combustion of the fuel will be accelerated. When the fire is first lighted, the patentee recommends that some pieces of wood should be placed inside the apparatus, in order to heat it, and to ensure a draft or upward current through it. The shape of the apparatus may be varied, although the patentee prefers that shewn; and the apparatus may be attached to, or form part of, the lower grating of a stove or grate, or it may be separate therefrom.

Fig. 5, is a plan view, and fig. 6, a vertical section, of a cap, to be applied to the top of the apparatus (as shewn at *a*, fig. 2,) when a kettle or other vessel is to be heated, in order that the kettle may rest upon the pins or studs *b*, *b*, instead of resting on the top of the apparatus and stopping the upward current. Fig. 7, is a plan view, and fig. 8, a vertical section, of a tube, to be applied to the apparatus (in the manner represented at *c*, fig. 3,) when it is desired to increase the draft.

The patentee claims the application of an apparatus, such as above described, to stoves or grates.—[*Inrolled January*, 1850.]

To HENRY MILLS STOWE, *of Bermuda, master of the brig James, for improvements in blocks and sheaves.*—[Sealed 20th June, 1849.]

THIS invention consists in improvements in blocks and sheaves for shipping and other purposes.

In Plate VI., fig. 1, is a side view, and fig. 2, is an edge view of a block, constructed according to this invention. Figs. 3, are detached views of the metal fork *a*, which receives the pin or axis of the sheave *b*, and consequently takes the whole of the strain to which the wooden portion of the ordinary blocks is subjected. *c*, is the pin or axis of the sheave, which secures all the parts together; and if it be made with a head at one end and a hole in the other for the reception of a cotter, the parts composing the block may be readily separated and put together again. When a block is to have two or more sheaves, the patentee prefers that the fork should be made with three or more legs, so that there will be a metal bearing to the pin or axis on either side of each sheave; but this is not absolutely necessary, as the fork may have only two legs for the outside of the block. The fork is applied, by preference, to the exterior of the block, which is cut away

suitably to receive the legs of the fork, in order that they may be flush with the outer surface of the block; but, if desired, the fork may be let into the interior of the block.

The improvement in sheaves relates to the bushing thereof, and is shewn at figs 4, and 5,—figs. 4, being side and edge views of a sheave, and figs. 5, being side and edge views of a bushing, which is made in one piece, and is screwed into the sheave.

The patentee claims, Firstly,—the improvements in blocks above described. Secondly,—the improvements in sheaves above described.—[*Inrolled December,* 1849.]

To Arthur Howe Holdsworth, *of the Beacon, Dartmouth, Esq., for improvements in the construction of marine boilers and funnels of steam-boats and vessels.*—[Sealed 9th August, 1849.]

This invention consists in certain improvements in constructing steam-boilers and funnels for steam-vessels, in order to obtain greater security against fire, and to relieve the men employed near such boilers and funnels from the effects of the unwholesome atmosphere produced by iron being heated by fire immediately in contact with it.

The improvement in steam-boat funnels consists in surrounding the funnel, from the boiler to the upper deck, with a metal casing, leaving a space of about three-quarters of an inch all round between the casing and the funnel, into which a continuous supply of cold water is caused to enter near the bottom, and to pass away therefrom at the upper part; and, by means of this continuous current of cold water, the radiation of heat from the funnel is prevented. The water may be obtained from a reservoir, which is supplied by the action of the paddle-wheels; or the water may be supplied to the casing by means of a pump or pumps, worked by the steam-engine that propels the vessel, or by the "donkey" engine used in large steam vessels for working the feed-pumps.

The improvements in boilers consist in so constructing the smoke-box or fire-doors, or screen-doors placed in front of the fire-doors, that water may be caused to circulate through the same. The patentee describes the application of this part of his invention to the smoke-box doors of tubular boilers. These doors, which are hinged to portions of the boiler that contain water, are commonly made of single sheet-iron; but the patentee constructs these doors of two thin plates of iron,

rivetted around the outer edges, and strengthened by stays to keep the plates at the proper distance apart, say, from half an inch to three-quarters of an inch; and the doors are filled with water from the interior of the boiler by means of hollow hinges or pipes, of the kind shewn in Plate VI., at fig. 1. The hollow hinge consists of two bent pipes *a, b*; one is fixed to the hollow smoke-box door and the other to the boiler; and the two are connected together by a water-tight joint. The hollow hinges may serve as the hinges on which the doors are to move, or ordinary hinges may be employed in addition to them. Screens, constructed like these doors, may be placed in front of the fire-doors and secured to the boiler by similar hinges or pipes;—the lower hinge being supplied with water by the feed-pipe of the boiler (which is bolted to the lower pipe of the hinge, as shewn at *c*, figs. 2, and 3,); and the upper hinge being connected with the boiler, as described with respect to fig. 1. To facilitate the opening and closing of these doors, each door is furnished with a castor or wheel, to run upon the floor of the stoke-hole and prevent the weight from straining the upper hinge or pipe. The lower edge of the doors is from six to twelve inches above the floor, to admit of a current of air passing into the ash-pit.

The patentee claims the so arranging smoke-box or fire-doors, or screen-doors to the fire-doors of marine steam-boilers, that water may be caused to circulate therein, as described; also the circulation of water in spaces within metal casings to funnels of marine steam-boilers.—[*Inrolled February,* 1850.]

To George Heaton, *of Birmingham, engineer, for improvements in locomotive engines.*—[Sealed 9th November, 1847.]

This invention consists in the application to locomotive engines of counter-balance weights, moved in opposite directions to the pistons of the engines, for the purpose of preventing the ordinary oscillating movement of locomotive engines.

In Plate VI. part of a locomotive engine is shewn, with this invention applied thereto. *a,* is the steam-cylinder, the piston-rod of which is connected by the rod *b,* with a crank *c,* on the axle of the driving-wheels. *d,* is another crank, on the opposite side of the same axle, connected by the rod *e,* with the weight *f,* which is carried by two rods *g, g,* jointed to the fixed arms or supports *h, h*; or, instead of the weight being suspended, it may slide on a fixed guide-rod, or it may be otherwise arranged suitably for being moved to and fro;—

the object to be attained being to have a weight constantly moving to and fro in an opposite direction to the piston; and such weight and the apparatus moved therewith should correspond, as nearly as possible, with the weight of the piston and the parts moved therewith. By the arrangement represented, it will be evident that the weight *f*, will always be moved in an opposite direction to the piston; and the patentee states that, by the application of such a weight to each of the engines of a locomotive, the uneasy and oscillating motion thereof will be, for the most part, if not wholly, overcome. The dotted lines indicate the position of the various parts when the piston is near the middle of its stroke, and when it is at the end thereof.

The patentee does not confine himself to the above details, so long as the peculiar character of his invention, viz., that of applying a counter-balance weight moving in opposite directions to the pistons of locomotive engines, be retained; but he claims the application of counter-balancing weights moved in opposite directions to the pistons of locomotive engines, as described.—[*Inrolled May*, 1848.]

To ALEXANDER MUNKITTRICK, *of Manchester, in the county of Lancaster, merchant, for an invention of an improved composition of matter which is applicable, as a substitute for oil, to the lubrication of machinery and for other purposes,—being a communication.*—[Sealed 1st May, 1849.]

THIS improved composition to be employed for lubricating machinery, and for other purposes, consists in the admixture of caoutchouc, dissolved in spirits of turpentine or other solvent of that gum, with carbonate of soda, glue, common animal or vegetable oil, or other cheap fatty matter, and water, which may be used in various proportions, according to the purpose for which the composition is required.

The following proportions of the ingredients have been found to produce a compound well suited for lubricating purposes, viz.:—Four pounds of caoutchouc with sufficient turpentine to dissolve it, ten pounds of carbonate of soda, one pound of glue, ten gallons of common grease, and about ten gallons of water. To prepare the compound, the water is first heated in any convenient vessel, and the glue and soda are dissolved therein, with continued agitation, by stirring, to diffuse the matter equally through the water; the oil or grease is next added; and, as soon as it has become well mixed, the dissolved caoutchouc is added, and the stirring is continued

until the ingredients are all thoroughly incorporated: the mixture will then be found to have assumed a homogeneous character, in its general appearance resembling oil, and will be fit for use;—it may be stored away in bottles, barrels, or other convenient vessels.

Some of the materials employed in the above-described composition may be replaced by others possessing similar properties; as, for instance, instead of the glue, gelatinous matter, in other forms, may be used; in place of the caoutchouc, gutta-percha or others of the soft gums may be employed; instead of carbonate of soda, some other carbonate will answer; and the anti-attrition composition would not be essentially changed in its character by such substitutions or replacements. It is not, therefore, intended to limit the claim to the precise ingredients above enumerated; but it is contemplated and intended to vary the articles themselves, and the proportions in which they are combined, as economy in their cost or adaptation to particular purposes or other circumstances may render expedient.

The patentee, in concluding his specification, remarks that his invention consists essentially in the combination of the oil and the elastic gum; the other ingredients being merely for the purpose of facilitating their admixture and correcting their impurities when they are used in a crude state; but if the oleaginous matter and gum employed are refined, most of the other ingredients may be dispensed with. This compound, being as fluid as oil, is applied as a lubricator in precisely the same manner.

The patentee claims the combination of ingredients herein described, or of others possessing similar properties and forming an analogous compound (whether the proportions be the same as herein set forth, or varied to any extent that the same may admit of) without changing the peculiar character of the compound, to be employed, as a substitute for oil, for the lubrication of machinery and for other purposes.—[*Inrolled November*, 1849.]

To AUGUSTUS ROEHN, *of Paris, in the Republic of France, Gent., for an invention of improvements in making roads and ways, and in covering the floors of court-yards, buildings, and other similar places,—being a communication.*—[Sealed 1st August, 1849.]

THIS invention consists in the combination and employment of certain substances for the purpose of covering the surfaces

of roads and ways and the floors of court-yards, buildings, and other similar places; and consists, firstly, in the production of a hard and durable asphaltic mastic, for covering roads or ways, and which is to be laid down in a solid state, in slabs, instead of being melted, as is usually the case when asphalte is used. This paving material is produced by mixing together 176 lbs. of rock-asphalte, 15 lbs. of Bastenne or other pitch or tar, and 7 lbs. of pyrogenous oil of resin or fixed oil; or by mixing together the following substances, viz., 220 lbs. of common lime, grey or hydraulic lime, or other calcareous substance, in a state of powder, 170 lbs. of refined coal-tar, and 7 lbs. of pyrogenous or other similar oil. The tar or pitch is to be carefully melted over rather a slow fire, and well mixed with the other substances in the following manner:—First, the pounded asphalte, lime, or other solid substance, is to be thrown into the pitch or tar, and the mixture carefully stirred; the oil is then added; and the whole is allowed to simmer for a short time.

The above proportions will of course be varied according to the degree of consistence required and the temperature at which the slabs are laid down. It should be understood that the object of the oils is to impart toughness to the material, and render it less liable to break. A quantity of small gravel (say 60 per cent.) may, if thought advisable, be mixed with this material before forming it into blocks or slabs.

The invention consists, secondly, in certain improved methods of covering roads or ways with calcareous asphalte rock, either natural or artificial. These methods will vary to some extent, according to the locality in which the work is to be carried on, the climate, or temperature of the weather, and the nature of the materials to be obtained, and other contingencies (without, however, departing from the principal features of the invention, or in any manner affecting the result desired); the patentee, therefore, describes several methods which have been found to answer, leaving it to the operator to choose that which may be the most suitable for his purpose.

First process.—Employment of the natural asphaltic rock.—The road having been properly prepared, as regards form and dimensions, and having been well levelled and beaten down, the following operations are proceeded with:—The road is covered with a layer of gravel, to the depth of from one and a half to two inches, which is well watered and beaten down. Upon the surface, thus prepared, is spread a layer of macadamized stones, to a depth of about four inches. About one-half of these stones is laid on at first, in order to facilitate the

beating down; and afterwards the remaining portion is added. On each layer of stones is laid a thin layer of sand, which is watered, in order to drive it into the interstices between the stones. A quantity of asphalte stone is broken into pieces, of the size of the stones usually employed for macadamizing roads, and varying according to the thickness at which it is intended to be laid on,—some of the pieces being about a quarter of an inch thicker than the bituminous layer, in order to allow for the compression caused by the beating down: for instance, for a layer of about one inch and three-quarters thick, the stones should be broken to a size of about two inches, one and a half inch, and one inch thick,—that is to say, the largest should be about one-sixth of an inch more than the layer of asphalte; and, in order to obtain these stones of the size required, they should be passed through sieves, having meshes of a corresponding size. A vessel is provided, capable of containing about 200 lbs. of gas-tar, more or less, according to the work to be done; and the broken asphalte is put into a basket of wood or iron, and steeped lightly in the gas-tar, in order to take up any dirt that may be on their surface, and to facilitate their adherence when laid down. These pieces, when taken from the large vessel, are shaken up in the basket, in order that they may be uniformly, although slightly, covered with oil; after which, they are put into a vessel, having a false bottom, either perforated with small holes, or made of wire-gauze, or a grating, in order to allow the oil to drain off; and, when the pieces of asphalte are sufficiently dry, they may be laid by for use, or laid down immediately. The road having been prepared as above described, two straight pieces of wood or other suitable material, about one-sixth of an inch lower than the largest of the pieces of asphalte employed, are laid down parallel to each other, and the stones are thrown down between them with a shovel, and made to lie as close as possible and cover the two straight pieces. The stones are then beaten or rolled (the latter method is preferred as being less expensive) until perfectly level and compact,—care being taken not to allow horses to pass over the surface when thus prepared. The interstices between the stones are then to be filled up; for which purpose a mastic is employed of a more yielding nature than the asphaltic rock, in order that it may, by reason of its elasticity, furnish a hold for the horses' feet, and maintain its consistency at any temperature.

Elastic mastic.—This elastic mastic is composed of the following ingredients, viz.:—22 lbs. of mineral Bastenne pitch,

or coal-tar pitch, or other analogous substance, 66 lbs. of pyrogenous oil of resin or any analogous fatty oils not affected by frost; 686 lbs. of natural asphalte rock, reduced to powder; and 206 lbs. of small gravel, of as calcareous a nature as possible,—making altogether 980 lbs. If any calcareous substance, such as chalk, lime, rag-stone, &c., be employed instead of asphalte, the following proportions, or thereabouts, must be observed, viz.:—686 lbs. of lime, chalk, &c., 88 lbs. of mineral pitch, 88 lbs. of pyrogenous oil, and 206 lbs. of small gravel,—making a total weight of 1068 lbs. This mixture is allowed to simmer over the fire for an hour, and is well stirred until the ingredients are perfectly mixed. The mastic, thus prepared, is then ladled out and poured quickly over the road. It is then spread or scraped with a spatula, in order that it may only enter the interstices, and not cover the stones, as the surface of the road would be thereby softened.

Second process.—Employment of artificial calcareous asphalte stone.—As natural calcareous asphalte rock is often difficult to procure, an artificial stone may be substituted for it, which may be prepared as follows:—Take any soft calcareous stone, chalk, rag-stone, sand-stone, potters' clay, or any other substance of a calcareous or argillaceous nature, and at the same time solid and absorbent; and, after breaking this material to the size above mentioned, in reference to the asphaltic rock, and passing it through sieves, submit it to a gentle heat in an oven, for the purpose of drying it.

Into a boiler, capable of being hermetically closed, put the following ingredients, in any desired quantity, but in the following proportions, viz.:—110 lbs. of Bastenne pitch or coal-tar pitch of the same consistence, and 5 lbs. of pyrogenous oil of resin, or any analogous oil; and when these substances have been melted and well mixed, then throw a quantity of the artificial calcareous asphalte stone, previously dried in an oven, as above stated, in order that it may be saturated with the liquid. Supposing the stones to be from an inch and a half to two inches in size, they should be left in the liquor about half an hour, or more. They are then to be taken out and put in a vessel, constructed in such a manner that the superfluous bitumen may run off. The time necessary for the saturation of the stones will depend upon their size, or the quantity of bitumen they are required to take up. By this means any required degree of consistence may be given to the artificial asphalte rock, according to the temperature of the country where the works are carried on, in order that

the material may always offer the required degree of resistance. The average quantity of bitumen used is 13 per cent. This artificial asphalte stone is employed in the manner pointed out in the first process, with referenee to the employment of the natural asphaltic rock.

Third process.—Employment of either natural or artificial asphaltic stone.—Either natural or artificial asphaltic rock or stone may be made up into mastic, to be employed, as before, with Bastenne bitumen or gas-tar, brought to the same consistency, or any analogous material which will impart to it the character of calcareous asphaltic rock; and, when prepared, this artificial stone must be broken in pieces, and treated in the way above described for natural stone in the first process already alluded to.

Fourth process.—Economy of the asphaltic substance.—If it be required to greatly economize the calcareous asphaltic stone, it is advisable to proceed as follows:—Take hard stones, broken in the same manner as for macadamized roads, and of about the size of a cubic inch, as above mentioned, and prepare them by placing them in baskets and steeping them in bitumen or gas-tar, in the manner described in the first process. On being taken from the bitumen or gas-tar, the stones are to be thrown into some pulverized calcareous body and well shaken, in order that their surface may be well covered. They are then spread on the road, as mentioned in the first process, and are used either as a foundation without any thing else, or mixed with broken asphaltic stone. When the road has been thus covered, the largest interstices are filled with natural or artificial asphaltic rock, of a less size than those already laid down; they are then beaten down or rolled, as mentioned in the first process; and the road is finished with elastic mastic, as before explained.

Mastic in the form of sand.—There are certain purposes for which the elastic mastic already described should be employed; for instance, for a wooden bridge, or a suspension bridge, where there is constant movement. For such purposes the mastic should be employed in a hot state, and be of a viscous and elastic consistence, so as to adhere firmly, and not be liable to be injured by sudden shocks of bodies running or rolling over it; but, for ordinary roads, the mastic in the form of sand (to be laid down in a cold state) is preferred, and also for finishing roads, as above described. The materials for, and method of, preparing this substance are as follows:—25 lbs. of Bastenne bitumen, or pitch, or coal-tar, brought to the same consistency, or any other analogous sub-

stance; 65 lbs. of pyrogenous oil of resin, or any other analogous oil, of a viscous nature, and not liable to be affected by frost; 780 lbs. of calcareous asphalte rock, in powder; and 275 lbs. of gravel, from 1-25th to 2-10ths of an inch in diameter. Or, if the above materials cannot be readily procured, the following may be substituted, viz., 100 lbs. of the mineral pitch, or other analogous substance, 100 lbs. of the resinous oil, or other analogous substance, 690 lbs. of pulverized calcareous earth, and 275 lbs. of gravel, as above mentioned.

Instead of common gravel or sand, the bituminous sand of mines may be employed (called, in French, *molasse bitumineuse*); in which case a less proportion of Bastenne or other bitumen may be used. The proportions may, however, be modified, according to the quality of the materials. When the layer of asphalte materials has been sufficiently beaten down, the powdered mastic is spread over it with a shovel; a broom is passed over it, in order to fill up the interstices between the stones, without leaving any on their surface; and it is then beaten and rolled, in order to consolidate the whole firmly together. The road will now be found firm enough for any kind of traffic, and perfectly unyielding to the wheels of vehicles. After the lapse of 48 hours, the roadway made with this pounded mastic will be found to be as even as that made with the mastic employed in a hot state, as above mentioned.

Brush mastic.—It sometimes happens that the road is worn into holes in some parts—this may be remedied by laying on several layers of a viscous mastic, composed of two parts, by weight, of pyrogenous oil of resin and one part of Bastenne bitumen or other analogous material. As each layer is laid on, pulverized calcareous earth, chalk, or lime, is thrown over it, and afterwards a small quantity of sand. These substances will become incorporated with the mastic; and, by this means, the whole roadway may be covered, when there is not much traffic.

It may be here observed, that the result of the four methods above described is the same; but the choice of them depends upon the locality, climate, and the facility of procuring the different materials. The above materials may also be made up into blocks or slabs of any required size, and laid down in the same manner as ordinary stones.

From the foregoing description it will be understood that the principal feature of the invention consists in employing the asphalte in a cold state, and causing it to bind together

by simple compression;—the asphalte being rendered soft by means of the oleaginous or bituminous substances, which, after a certain time, penetrate the asphaltic substance, and allow of its binding well together on being submitted to pressure by the operation of beating or rolling. This soft state allows also of the introduction of hard matters, such as gravel, stones, rubbish, and other similar substances.

When the surface of the layer of asphaltic matter has not the required consistence, this may be remedied by the addition of a proportionate quantity of asphaltic rock, or pulverized asphalte, or any other calcareous matter, and, if too hard, by the addition of elastic mastic.

The above materials may also be employed in a cold state for filling up the joints of stones which are exposed to the action of water or the atmosphere. For this purpose, after having laid on (with a brush) a slight coating of oleaginous or bituminous substances, in order to clean off the dirt and facilitate adhesion, the mastic must be employed in the same manner as when caulking a vessel. A layer of the elastic mastic above described, or of the brush mastic, is then applied.

The patentee claims, First,—the preparation of a durable and hard mastic, by the employment of bitumen or pitch, fixed oils, and calcareous substances, as above mentioned. Secondly,—the preparation of an elastic mastic, as above described. Thirdly,—the manufacture of an artificial calcareous asphaltic rock, as described. Fourthly,—the employment, in a cold state, of mastic, or natural or artificial asphaltic rock, either alone or in combination with stones or other hard bodies, for the purpose of forming or covering roads or ways, or for other similar purposes, as above described. Fifthly,—the preparation and employment of a mastic, called "mastic in the form of sand," as described. And, Lastly,—the preparation of asphalte in such a manner that it may be rendered soft without heat, and be caused to bind by simple compression, forming, thereby, a hard and durable asphaltic surface.—[*Inrolled February*, 1850.]

To George Benjamin Thorneycroft, *of Wolverhampton, iron master, for improvements in manufacturing railway tyres, axles, and other iron, where great strength and durability are required.*—[Sealed 26th June, 1849.]

The mode of manufacturing tyres according to this invention is as follows:—A pile of iron is made with the outer parts of

the toughest fibrous iron, and the inner or centre part of charcoal iron, made into one substance of a homogeneous or solid body, perfectly free from laminæ;—between the slabs of the two kinds of iron, thin puddled or other bars of iron are placed; and, as these bars are of much less substance than the slabs, they become hot sooner; and, by the time that the pile is brought to a welding heat, the thin iron in the joints will be in a state of fusion, and will cause a more perfect union of the parts of the pile. The patentee says, "I make this pile into a bloom, either by hammering or rolling; and, afterwards, roll the bloom into the tyre edge-way in which it was piled or put together,—thus producing a tyre with the middle or wearing part of crystallized homogeneous iron, much harder and more durable than fibrous iron, and the outer parts of the toughest fibrous iron,—thereby giving great strength to the outer parts, and a greater degree of hardness and durability to the inner or wearing part." He states, that he does not claim the common modes of making charcoal tyres, *i. e.*, making them wholly of charcoal iron, or making the front part of charcoal iron and the back part of best No. 3, fibrous iron.

He proceeds in the same way to make a cheaper kind of tyre, by using best puddled refined No. 3, iron, made into a slab without piling or fagoting, and therefore perfectly homogeneous,—being made from one puddled bar, or two, if required, but put together in a "maiden" state before being operated upon to make them solid. He does not confine himself to the precise modes described, so long as a tyre is produced, with the outer part of tough fibrous iron, and the inner part of crystallized homogeneous iron, as shewn in the section, fig. 1, Plate IV.

The other part of the invention relates to the manufacture of axles and bars, and is carried out in the following manner:—The patentee states that he makes an axle or bar of the same compound principle. He takes a box-pile of best No. 3, fibrous iron, made as represented at fig. 2, or fig. 3; and he coats the centre-piece with fire-clay, or any other substance that will prevent it from welding or uniting with the other parts of the pile. The patentee says, "By this means I prevent the iron or centre of the pile from becoming one substance, or homogeneous, throughout: this method protects the fibre of the iron, and prevents it from becoming crystallized throughout, which is the case with all iron when welded perfectly sound in large substances, as in axles."

Another improvement consists in leaving the centre-bar out

of the pile, and then rolling the pile, so that the space in the middle just closes up by the time that the axle or bar is reduced to the required size, when the iron will have lost its welding heat, and will not unite or become solid at the centre; so that the axle, in its cross section, will consist of a series of concentric rings, extending from an unwelded centre to the outside of the bar, as shewn at fig. 4.

Another mode of effecting this consists in taking two half-round or two half-square moulds of iron, as represented at figs. 5, and 6, and rolling them into an axle or bar; so that the hollow part in the centre just closes up when the iron is reduced to the required size. An axle or bar is thus made with an unwelded centre,—the cross section consisting of a series of concentric rings, which causes the axle or bar to be much stronger than when made from a solid pile or bloom.

The patentee does not confine himself to these precise methods, so long as an axle or bar of iron is produced by keeping the iron in a tubular form until it is rolled into a close body, but not welded in the centre. He does not claim the right to make hollow axles, nor the exclusive use of the box-pile; but he claims, as his invention, producing a semi-compound axle or bar of iron, with the centre-piece not perfectly united to the outer iron,—being prevented from uniting by a coating of fire-clay or other substance; and, in the second place, producing an axle or bar of iron, where great strength is required, from a hollow pile, so constructed that, by the time it is rolled down to the required size, it has become a solid body, but not welded in the centre.—[*Inrolled December*, 1849.]

To Thomas Greenwood, *of Goodman's-fields, in the City of London, sugar refiner, and* Frederick Parker, *of New Gravel-lane, Shadwell, animal charcoal manufacturer, for improvements in filtering syrups and other liquors.*—[Sealed 4th July, 1849.]

This invention consists in causing syrups and other liquors containing saccharine matters to be filtered in succession through a series of filter beds, and in such manner that the liquor shall be first run into and filtered through that one of the series of filter beds which has been longest in action; then through that one which has been in action for the next longest time; and so on, until the filtration is completed by passing the liquor through a fresh bed of filtering material. By this means, amongst other advantages, a uniform daily product

will be obtained, in place of daily increasing inferiority of color of the filtered liquor, and the consequent diminished value of the sugar produced therefrom, which necessarily results from the ordinary mode of using filter beds: viz., employing one filter bed for several days in succession, until it is too impure to be used any longer; and then substituting a fresh one and employing it, in like manner, until it is too impure for further use.

The patentees do not confine themselves to any particular number of filter beds, but state that they have employed six, arranged in a circle,—five being always in action and one out of action. They use the ordinary filtering materials; and, for a like quantity of syrup, they employ the same quantity of filtering materials, divided amongst five filter beds, as would be used in one filter bed when operating in the ordinary manner. The five filter beds should each have the same superficial area as the single filter bed in ordinary use; and such a head of syrup should be maintained as would ensure the delivery of a like quantity of filtered syrup to what would be obtained from the common single filter.

The mode of working with six filter beds is as follows:—Supposing five filter beds, Nos. 1, 2, 3, 4, 5, to be in action, of which No. 1, has been the longest in use, No. 2, the next longest, and so on.—As soon as No. 1, has become too impure to be used any longer, it is thrown out of action,—No. 2, becomes the first of the series, and No. 6, is brought into use as the last of the series. The process of filtration goes on until No. 2, becomes too impure to be longer employed; it is then thrown out of action, and No. 3, becomes the first of the series; and No. 1, (which has been supplied with clean filtering materials in the meanwhile) is brought into use as the last of the series. The several filter beds are connected together by pipes (provided with stop-cocks) in such manner that the filtered syrup will pass from the lower part of No. 1, into the upper part of No. 2, and from the lower part of No. 2, into the upper part of No. 3, and so on.

The patentees do not make any claim to the filter beds, they being separately like those previously in use; nor do they confine themselves to the number mentioned as constituting the series; but what they claim is, the mode, above described, of filtering syrups and other liquors containing saccharine matters.—[*Inrolled January*, 1850.]

Scientific Notices.

ON THE COLORING OF GLASS BY MEANS OF METALLIC OXIDES.

BY M. G. BONTEMPS.

[Translated for the London Journal of Arts and Sciences.]

In consequence of the demand which has arisen within the last fifteen years for stained glass windows and colored flint glass in Bohemia, Germany, France, and England, considerable attention has been directed to the coloring of glass by metallic oxides. For this purpose, there was most probably tried, in the first instance, the processes indicated in the works of Neri, Merret, Kunckel, Ferrand, Haudiquer de Blancourt, and others, with frequent ill success, leading to the conclusion that the authors had not obtained the results they pretended to have produced;—the truth of the matter being, perhaps, that they did not operate under the same circumstances. At all events, these recipes only appear to have an empirical value, as chemistry had not yet become a science, but was merely an agglomeration of facts without a systematic arrangement,—the phenomena observed not being then explicable by any physical laws. At a later period, the science of chemistry admitted of the metallic oxides, as well as their various combinations with acids, being readily analyzed. Glass having been considered, by analogy, to be a *salt*, either with a simple or compound base, general axioms have been admitted in coloring that substance by means of metallic oxides. It has been said, for instance, that silicates of potash and soda are colorless; that the silicate of potash or soda and manganese is purple; that the silicate of potash or soda and cobalt is blue; that the silicate of potash and deutoxide of copper is blue; that the silicate of potash and protoxide of copper is red; that the silicate of potash and gold is purple, &c. Such axioms as these are sufficient for purposes where a superficial knowledge only is required; but, on entering upon a further investigation of the phenomena produced by the employment of metallic oxides in the manufacture of glass, it will be at once seen what a wide field is open for experiment, and how unsatisfactory is the information afforded.

The following statement of some of the phenomena produced by a few of the metals will, perhaps, prove interesting; as, although those mentioned are the metals generally employed for coloring glass, the phenomena they present do not appear to have been made the subject of close investigation.

I. *Iron.*—It is generally admitted that oxide of iron imparts a green color to glass; but the truth is, that this is only the case under peculiar circumstances. It is a fact well known to porcelain and earthenware manufacturers, that oxide of iron is the coloring matter of a fine purple red enamel, after firing in the muffle (and it may here be mentioned, that enamel has been

proved to be merely glass). If the temperature were raised too high, this enamel would lose its purple tint, and incline to orange. The oxide of iron, therefore, produces three of the prismatic colors, even at what may be called low degrees of temperature, when compared with that of the glass furnaces presently to be mentioned.

If, in a pot containing white or flint-glass in a state of fusion, a small portion of iron be introduced whilst working, it will, by reason of its gravity, fall to the bottom; and, on taking the pot from the oven, a portion of glass, which has become of an orange or yellow color, will be found near the iron, which has become partially oxidized.

Another example of the yellow color produced by oxide of iron is found in the manufacture of artificial avanturine. It is known that this avanturine is produced by exposing soft glass, containing a large proportion of the oxides of iron and copper, to a temperature below its point of fusion;—the copper is converted into metallic crystals; and the glass, which is colored by the oxide of iron only, acquires a brownish-yellow color,—the yellow color increasing in proportion to the degree of reduction of the copper.

To return to the ordinary circumstances of the coloration of glass by oxide of iron;—it will be seen that, at a moderate temperature, such as that of covered pots for flint-glass, the oxide of iron gives a green color, approaching nearer to yellow than blue. It is generally by combining oxide of iron with oxide of copper (which gives the blue) that all shades of green are produced. The greenish color of bottle-glass must also be attributed to oxide of iron, combined with the carbonaceous matters contained in the mixture. But, on melting at a high temperature (in the manufacture of window-glass, for instance), it is remarked, that the addition of a small proportion of oxide of iron to the mixture produces a glass of a blueish color. Manufacturers of bottle-glass are also aware that, upon the glass cooling in the pot, it becomes blue and opaque before becoming devitrified.

From the foregoing observations it will be understood that glass receives from the oxide of iron all the prismatic colors; and that these colors are produced in their natural order, and in proportion to the elevation of the temperature to which the glass is submitted.

II. *Manganese.*—It is generally known that oxide of manganese imparts to glass a purple color, which property is not only applied for obtaining purple glass, but more especially for making what is called "glass-makers' soap," which is used for neutralizing the slight greenish color produced by small proportions of iron and carbonaceous matters existing in the materials which are employed in manufacturing white or flint-glass; but what is very remarkable is, that the slight purple color produced by oxide of manganese is very liable to become weaker; for, if the glass remains too long in the melting furnace and afterwards in the

cupola, the purple first changes to a light brownish-red, then to yellow, and, afterwards, to green.

There is also a remarkable fact relative to the presence of manganese in the composition of glass. White glass, in which a small proportion of manganese has been employed, is liable to become yellow on being exposed to the light. On the glass being melted, for the purpose of making the celebrated Augustin Fresnel's polyzonal lenses, for which it was desirable to have the glass of the greatest possible purity, those prismatic pieces of glass became yellow in a short time, without losing their transparency or polish. This yellow color, it would seem, was due to the presence of manganese; as, on the use of that substance being discontinued, the yellow color no longer appeared. Moreover, in order to shew that the coloration was the effect of light, a prismatic ring, which had been recently manufactured from glass containing manganese, was broken into two pieces; one of which, on being exposed to the light during several weeks, became yellow; whilst the other, which was kept in the dark, underwent no alteration, but retained its whiteness.

It is also well known that some squares of glass (particularly the Bohemian glass) acquire a slight purple tint, after having been exposed, for a length of time, to the action of light. The same effect is produced in window or flint-glass, containing a small proportion of manganese, when allowed to remain in the flatting or annealing oven a sufficient length of time, to allow devitrification to commence;—in this case, the interior of the glass becomes an opaque white, while the outside acquires a purple tint.

It is admitted that certain of the facts above mentioned, relating to coloration, might be explained by attributing them to various degrees of oxidation; and that the manganese, for instance, loses a portion of its oxygen when the glass passes from purple to yellow; but there appears to be a doubt whether this suffices to explain the phenomena (which may be termed photogenic) which take place when the glass is in a solid state.

III. *Copper.*—This metal, at its highest degree of oxidation, imparts to glass which is entirely free from iron, a sky-blue tint, inclining more to green than purple; and, at its lowest degree of oxidation, it gives a ruby color.

It has always been the custom to color window-glass red by means of protoxide of copper; but that color is not easily obtained, as it is fugitive, and must be watched for, and arrested the moment it appears;—the production of this color, therefore, gives rise to a number of interesting and curious observations. When the red glass is in a proper state for being blown, on being dropped into water, a yellowish-green globule will be produced; on this yellowish globule being heated to the point of fusion and cooled slowly, the red color will gradually appear as the glass cools, until it assumes the most beautiful ruby tint, inclining

more to orange than purple. In some instances, this color is so delicate that the cooling process, which takes place in the ordinary mode of manufacture, is opposed to the production of the red tint; and it is necessary to expose the manufactured glass to the temperature of a reverberatory furnace;—in which case, the red color will be seen to increase gradually in intensity, until it attains the maximum. If the temperature be too high, or if the ruby glass already produced be placed in a muffle at too great a heat, the light orange-red color soon becomes changed,—first, to crimson, and, finally, to purple. If the heat be increased, it will first assume a blueish tint, and afterwards become colorless. It is therefore ascertained that ruby glass should be submitted to the lowest possible temperature, in order to obtain the brightest tints. From these observations it may be concluded that glass, which contains copper in the state of protoxide, by the addition of tin or carbonaceous matters, will assume successively all the colors of the spectrum, under circumstances which do not appear to be the effect of modification by means of oxygen.

IV. *Silver.*—Oxide of silver is not often added to the compound which is melted in glass furnaces, but is generally employed for staining glass a transparent yellow color; for which purpose it is spread upon the surface and burnt in. This color is produced without the addition of any flux, by simply spreading upon the surface of the glass a small proportion of oxide, or any salt of silver in a very comminuted state, mixed with any neutral excipient, such as pulverized argil or red oxide of iron, and exposing the glass to the heat of a muffle. The excipient is then removed by scraping or brushing the surface of the glass, which will then be found to be colored yellow, varying between lemon color or greenish yellow and deep orange, according to the quantity of silver, and, especially, according to the quality of the glass. A red color may be produced by exposing the glass to the muffle twice.

M. Dumas found, by careful analysis, that glass which is susceptible of taking deep tints is composed of elements which approximate the most nearly to definite proportions; this agrees with the observation that glass must be entirely deprived of its excess of alkali by prolonged fusion at a high temperature, in order to enable it to take deep orange and red tints.

It is important not to raise the muffle to too great a heat, otherwise the surface of the glass would become opalescent; although, on looking through it, it still presents a yellow or orange color. On looking at it obliquely it reflects an opaque blue color; and at a still higher temperature it has a tendency towards a purple red when looked through, although the opacity of the surface is augmented, and the color changed to a brownish yellow. If, instead of tinting the glass in a muffle, the silver, added to a mixture of flint glass, be melted in covered pots as quickly as possible, the result is an agate-like semi-opaque substance, which,

by the combined effects of refraction and reflection, presents all the colors of the spectrum. This is the more apparent if the surface of the glass, which is generally an opaque yellowish green, be cut at different depths. These effects result from irregularities in the cooling, as has been seen to be the case with manganese and copper.

V. *Gold.*—Oxide of gold imparts to glass a purple color, which may, by increasing the quantity, be converted into purple red. For this purpose, a small proportion of the purple precipitate of Cassius is added to the flint-glass composition; and on the first fusion the composition furnishes merely a colorless transparent glass; but, on being again heated, its purple color is brought out. Thus, if a small solid cylinder be formed of the glass first fused, it will, on cooling, be quite white; but, on being afterwards exposed to the heat of the apertures of the furnace, it will gradually, as the heat penetrates, assume a red tint; and this color will become fixed by again gradually cooling in the annealing furnace.

It has also been observed, that by varying the degrees of temperature to which a piece of glass of a certain length is heated, and cooling it several times, many tints are produced, varying from blue to purple, red, opaque yellow, and green. It does not, however, appear certain whether this effect may not be attributed to some fragment of silver mixed with the gold employed; the only point which seems positive being the existence of the purple color, which is developed by a second heating, in glass containing gold in its composition. To these results upon coloration by metallic oxides, may be added an effect produced in the coloring of glass by means of carbon, which is of the same nature as those mentioned with respect to the coloration of glass by means of copper and gold. An excess of carbon in the composition of a silico-alkaline glass furnishes a yellow color, which is not so brilliant as silver-yellow, but is nevertheless sufficiently fine to be employed for church windows. This yellow color may also, sometimes (according to the nature of the wood from which the charcoal is made, and the period at which it is cut), be converted into deep red, by a second exposure to the action of the fire.

It may be doubted whether all the facts above mentioned can be explained by the various degress of oxidation of metals.

The multiplicity of colors, which exceed in number those of the oxides attributed to each metal, should lead to an enquiry as to whether these phenomena may not be the results of physical laws. It seems to be a peculiar feature of the present time, and doubtless the result of the great progress made in chemistry and physics, so to unite the study of these two sciences as to render them inseparable from each other. The various facts observed in the coloration of glass, and which are specially produced by the influence of different temperatures, may probably be attributed to some modification in the arrangement of the molecules,

giving rise to modifications in the reflection and refraction of the luminous rays; it may, moreover, be observed, that many of the results above mentioned are produced under certain circumstances which appear to place the glass in a condition of crystallization.

During the last century, Edward Hussy Delaval, acting upon Newton's experiments upon the coloration of thin plates, undertook some researches as to the causes of the changes of color in bodies; but the science of chemistry was not at that period in a sufficiently advanced state to enable him to found his observations upon experiments which could be relied on. At the present time, we have only to collect a sufficient number of facts to enable us to deduce therefrom scientific explanations, leading most probably to further improvements in the manufacture.

With regard to glass, the observations to be made concerning the form and arrangement of its molecules, are of an extremely delicate nature. This is demonstrated by the difference in the action of the light upon it, according to the degree to which it has been annealed. It is known that even a very slight degree of pressure, acting upon a portion of its surface, will suffice to produce thereon the power of double refraction; which is also communicated to it by imperfect annealing. This effect takes place, not only with glass which has been suddenly cooled down from a red heat to the ordinary temperature, and is therefore liable to fly, but also with lumps of glass which had been considered to be well annealed. These specimens of glass will present the phenomena of polarization, which increases the difficulty (already sufficiently great) attending the manufacture of glass for optical purposes. This difficulty, which is considerable even for lenses of three or four inches diameter, is much more formidable for those of ten or twelve; it has, however, been overcome even with a diameter of twenty-two inches. It would, nevertheless, be well for opticians to throw some light upon the various stages of the processes they employ for the construction of achromatic telescopes, as there is no certainty that the glass, which is now considered free from blemish, might not, under very strong magnifying power, be found to have imperfections which had not hitherto been supposed to exist.

ON THE EXTRACTION OF SILVER FROM ITS COMBINATIONS IN ARGENTIFEROUS MINERALS.

BY MM. MALAGUTI AND DUROCHER.

ALTHOUGH many skilful chemists have devoted their attention to the theory of amalgamation as a means of extracting silver from the mineral substances with which it is associated in nature, there remain still some points of obscurity in which the chemical reactions that occur in this process are anything but clearly understood. The details of the processes of extraction, particularly

that employed by the Americans, consequently present many imperfections, which it has been the object of our experiments to remove.

The numerous experiments that we have made have thrown some light upon the above difficult questions; therefore, without entering into minute details, we shall give a general account of the results at which we have arrived.

In the first place we have ascertained that the gangues which accompany the mineral compounds of silver play a much more important part, in reference to the extraction of the silver, than has hitherto been believed. The argillaceous gangue is that which appears to interfere most injuriously; the best are the quartzy or meagre gangues,—that is to say, those which have least tendency to form a thick pasty mixture with water;—the quantity of water must, however, here be taken into consideration, as enough should be employed to bring the mineral substance into a half-fluid state.

Certain gangues may exercise a chemical influence in the process of amalgamation; carbonate of lime, for example, which, under peculiar circumstances, may impede, very materially, the chloridization of the silver, previous to its amalgamation. This is also the case with some foreign metallic sulphurets, as the sulphurets of zinc, lead, &c.; on the other hand, many salts,—chloride of sodium, among the number, favor the production of chloride of silver, but an excess of the saline chloride is, however, injurious rather than useful.

In almost every one of the processes of amalgamation, the first operation consists in converting into chloride, either by the furnace or in the presence of water, all the sulphuret of silver, and even the metallic silver, contained in the mineral; afterwards, the chloride of silver, so formed, has to be reduced to the state of pure silver; and, in order to effect this, the process of amalgamation is employed: here, however, a considerable loss of mercury is experienced; for the latter substance reacts, not only upon the silver, but also upon the excess of the agents that had been previously employed to bring the silver into the state of chloride. If mercury alone be used in effecting the amalgamation of the silver in the chloride, that action is carried on very slowly, much more so than when the silver is in the metallic state, or even in the state of sulphuret. When, however, iron is used with the mercury, it reacts rapidly upon the chloride of silver, reducing the latter to the metallic state; so that it is very freely absorbed by the mercury. In the American method of working, the chloridization of the silver is extremely slow, requiring a considerable length of time before the conversion is complete; this is particularly the case when other metallic sulphurets are combined with the sulphuret of silver;—it often happens, in this process, that the combination of the silver with the chlorine takes place only after the action of the latter substance upon the other metals has terminated; and, even then, in addition to the incon-

venience arising from the time required in the operation, the action of the chlorine upon the silver remains, at last, more or less incomplete; and considerable loss may be sustained from the quantity of silver left in the inexhausted gangue.

The above considerations have led us to seek for a process by which the sulphuret of silver may be reduced at once, without previous conversion into chloride; by this means, much of the loss now experienced in the manufactories of America would be entirely avoided.

It is well known that many re-agents effect the reduction of the sulphuret of silver, either when it is alone or in combination with other sulphurets. We have tried, with this object, many of the metals; the agent which we, however, regard as the most effectual in its action, is metallic copper,—added to the sulphuret of silver at the temperature of boiling water, and mixed with certain saline compounds, such as sulphate of copper, sulphate of iron, or alum. The results which we have obtained, in subjecting many different varieties of sulphuret of silver to treatment with the above re-agents, appear sufficiently important to merit the attention of those who are working silver mines, as they lay open an entirely new field of research in the manufacture of that metal.

We have also made some experiments upon a process which has been recently adopted;—it consists in dissolving the chloride of silver in a concentrated solution of common salt. Setting aside the practical difficulties of this process, particularly that of filtration on a large scale, it is possible, by such means, to obtain the whole of the silver from a mineral which easily gives up its silver to the chlorine; besides this, if we compare the process with that of amalgamation, we shall see that the use of mercury is avoided; and, as this is an expensive agent, and one of which the production is limited, that difference alone is one of great importance. If the use of this process should become general, the manufacture and extraction of silver from its ores would, doubtless, receive a great and beneficial impulse.

ON THE PRESENCE OF LEAD, COPPER, AND SILVER, IN SEA WATER, AND ON THE EXISTENCE OF THE LATTER METAL IN ORGANIZED BEINGS.

BY MM. MALAGUTI, DUROCHER, AND SARSEAU.

A MEMOIR was lately presented to the *Academie des Sciences*, at Paris, upon the above subject by the authors. It has long been known that silver is very generally met with in metallic ores,—in galéna, in blende, and in pyrites, for instance. As salt water may, after a long-continued action, convert the metals of these substances into chlorides which would become dissolved in it, it was desirable to ascertain whether the water of the ocean does

not contain more or less of the metals which, under the form of sulphurets, may be present in the soils over which the water flows.

The presence of silver in sea water has been proved by two different methods. The water was taken up some leagues from the coast of St. Malo; and the fuci of the same district has also been submitted to examination. The species of this sea plant, most rich in silver, are the serratus and the ceramoides; the ashes of these contain about $\frac{1}{100,000}$ of the weight; while sea water contains no more than $\frac{1}{100,000,000}$. If the waters of the ocean be thus argentiferous, sea salt, and all the artificial products derived from it, will also probably contain silver. Experiment has, indeed, shewn this to be the case,—sea salt, commercial muriatic acid, and soda, contain minute quantities of silver. Does not the universality of this fact depend, however, upon the operation of some constant law, or upon an assemblage of various causes? The authors believed that this question would be resolved by the examination of the rock salt of Lorraine, which probably represents the bed of an ancient sea;—in this salt they have succeeded in discovering the presence of silver. The existence of this metal in sea water depends, then, upon a constant law. Keeping in view the object with which the experiments were commenced, they next wished to ascertain whether terrestrial plants do not assimilate, by means of their roots, the silver which may be presented to them in a state of solution. Water, which contains naturally many saline substances, and, among them, certain chlorides, may take up small quantities of silver, in consequence of its action upon the metallic sulphurets it meets in its course: the examination of the ashes of numerous vegetable substances from different sources proves that silver generally exists in vegetable tissues; this fact led to the expectation that silver might also be present in animals;—this seems to have been ascertained in examining large quantities of ox blood.

Lastly, it remained to discover, in the vegetation of the ancient world, a further proof of the oxide diffusion of silver throughout nature; and also that this diffusion is independent of accidental causes, or of circumstances connected with the present state of the earth. The ashes of different varieties of coal were, consequently, subjected to examination, but the presence of silver has not been discovered with so much distinctness as in the ashes of plants of a more modern epoch. After many useless endeavours the authors gave up the direct search for lead and copper in sea water; nevertheless they had reason to believe that both these metals exist in the ocean. In the ashes of many species of fucus, about $\frac{18}{1,000,000}$ of their weight of lead and a trace of copper were discovered,—a fact which proves that, although the quantity of lead and copper in sea water may be too minute to be detected by chemical re-agents, it is sufficient to be seized upon by the assimilative organs of plants.

ON THE NITRATES OF IRON AND SOME OTHER NITRATES.

By J. M. ORDWAY, of the Roxbury Laboratory, Mass.

SESQUINITRATE of iron may be easily obtained in the form of crystals by taking advantage of the fact, that this salt is almost insoluble in cold nitric acid.

When metallic iron is gradually added to nitric acid of sp. gr. 1·29, copious red fumes are given off, and the liquid assumes a greenish hue, till nearly ten per cent. of iron has been taken up. A further addition changes the color to a dark red; and, if the action be continued still longer, a rusty precipitate forms. If we stop short of this last point, and add to the product its own bulk of nitric acid of sp. gr. 1·43, an abundant crop of crystals will be deposited on cooling below 60° F. The same result may be attained by evaporating the greenish liquid, and adding acid enough to insure a considerable excess, before setting the solution aside to cool. If the first crystals are brown, they may be purified by re-dissolving in nitric acid, with the aid of a gentle heat, and allowing again to crystallize.

The crystals, thus obtained, have the form of oblique rhombic prisms, which are either colorless or of a delicate lavender color, but, when dissolved in water, yield a yellowish-brown solution. They are somewhat deliquescent, and very soluble in water; while, at a temperature below 60° F., a weighed quantity was not wholly taken up by over twenty parts of nitric acid of sp. gr. 1·37.

At about 117° F., this salt melts into a clear, deep red liquid, which in one trial remained fluid till cooled to 83° F., when the heat, developed by solidification, quickly raised the thermometer to $116\frac{1}{2}$°.

The composition of this substance, as indicated below, affords reasons for supposing that by its admixture with a bicarbonate, an intense cold might be produced. Such proved to be the case, for when two ounces of the bruised crystals were stirred up with one ounce of pulverulent bicarbonate of ammonia, the thermometer introduced fell from 58° to —5° F. Previous cooling is attended with an increase of effect.

These experiments being very tangible, would furnish excellent illustrations of the principles of latent heat.

A small quantity of the melted nitrate kept hot for several hours by means of a water bath, yielded a perfectly dry, dark brown, deliquescent powder, containing some water and one half the original amount of acid. More acid may be expelled by a moderate heat, but, to drive off the last portions, requires a temperature approaching to redness.

The well-drained crystals afforded by precipitation with ammonia 19·8 p. c. of peroxide of iron; and 100 grs. boiled with carbonate of baryta, gave a liquor which with sulphuric acid yielded 86·5 grs. of sulphate of baryta, indicating 40·104 p. c. of dry nitric acid. Hence the formula is probably $3(N,O_5)Fe_2O_3$,

+18H, which would give, in 100 parts,—nitric acid 40·095, peroxide of iron 19·819, water 40·086.

Basic nitrates.—A liquid is used in cotton dyeing, which is prepared by adding iron turnings to aquafortis till the solution assumes a very dark red color. A fair sample of this solution, of sp. gr. 1·478, was found by analysis to contain five equivalents of nitric acid to two equivalents of sesquioxide of iron. A portion of the same placed in contact with metallic iron, remained clear until nearly enough iron had been taken up to form a sesquibasic nitrate, $2(N,0_5)Fe,0_3$, when a rusty precipitate began to appear, whose exact nature it is difficult to determine.

A full sesquibasic nitrate was formed by adding crystals of the nitrate to the proper quantity of freshly-precipitated oxide of iron. And proceeding by the same means, but with slow and cautious steps, as into an unknown region, I was successively astonished by the discovery of soluble basic nitrates containing to three equivalents of acid, two, three, six, eight, twelve, fifteen, eighteen, and twenty-four equivalents of base, respectively; and then, from the slowness with which the union took place in the last, I supposed the limit reached. Yet this liquid was found to bear the addition of a small quantity of lime water, without change.

On arriving at these remarkable results, the question naturally came up, whether there were any chances of error. But on examination, no foreign substance was detected, and the analyses of the six, twelve, fifteen, and twenty-four basic compounds, agreed so nearly with the syntheses as to remove all doubts.

Which of these bodies have claims to be regarded as true atomic compounds, there seems to be no clue but analogy to determine. They all form intensely deep red liquids, which are not altered by dilution, nor by brisk boiling, provided the evaporation be not carried too far. By spontaneous evaporation they leave a very dark red powder, perfectly soluble in water. That left by the dodecabasic nitrate, was not deliquescent, and lost, 30 p. c. of its weight by ignition. Hence its empirical composition would be $N,0_5,4Fe,0_3+9H$.

When cotton cloth is dipped in any of these solutions, and dried, the oxide of iron becomes permanently attached. Indeed the adhesion of the base to cotton fibre, renders filtration through paper exceedingly slow.

Since spring and river water, and the solutions of most salts, are incompatible with the twenty-four basic nitrate, it was found necessary to use an abundance of distilled water for washing the oxide used in its preparation. So intense was the color of this liquid that, though containing only 3·4 p. c. of oxide of iron, two drops imparted a perceptible tinge to a pint of distilled water, In trying the reactions of various substances with it, all the iron appeared to be immediately thrown down by muriate of ammonia, chloride of sodium, iodide of potassium, chlorate of potash, sulphates of soda, lime, zinc and copper, nitrates of potash and soda,

and the acetates of baryta and zinc. Precipitates formed more slowly with the nitrates of ammonia, magnesia, baryta, and lead. Tartrate of soda furnished a precipitate soluble in ammonia. Ferrocyanide of potassium gave a dark peat-brown precipitate without the least tinge of blue. Ferrocyanide of potassium gave likewise a rich peat-brown precipitate. Tincture of galls afforded dark brown flocks, and, on standing some time, the supernatant liquor turned black. Alcohol, acetate of lead, acetate of copper, cyanide of mercury, nitrate of silver, and arsenious acid caused no change.

With the tribasic nitrate, muriate of ammonia, chloride of sodium and nitrate of soda produced no effect; while the sulphates threw down all the iron, prussiate of potash struck a blue color, and tincture of galls gave a black.

Nitrate of Alumina.—Nitrate of alumina crystallizes from a concentrated and somewhat acid solution, in colorless oblique rhombic prisms, whose height is generally small in proportion to their width. They are deliquescent, and very soluble both in water and in nitric acid. The crystals, like those of the other sesquinitrates, can be best dried by spreading them on an absorbent surface, and placing the whole under a bell glass, along with a shallow vessel containing sulphuric acid.

The salt was found to melt at 163° F., into a clear colorless liquid, which began to crystallize when cooled down to $147\frac{1}{2}°$, the thermometer rapidly rising, at the same time, to 102°. The melted mass parts with its acid much less rapidly than the nitrate of iron. One ounce of the powdered salt mixed with one-half ounce of bicarbonate of ammonia, lowered the thermometer from 51° to 10° F.

100 grs. of pretty dry crystals, yielded by ignition 13·7 grs. of alumina. Distillation with sulphuric acid gave 42 p. c. of nitric acid, and by boiling with carbonate of baryta, 42·42 p. c. was separated. The numbers corresponding to $3(N,0_5)Al,0_3+18$ H, would be, in 100 parts,—nitric acid 43·17, alumina 13·68, water 43·25.

Nitrate of alumina appears to form with the hydrate a series of salts similar to the basic nitrates of iron. But they have not as yet been fully examined.

Nitrate of Chrome—Nitrate of chrome crystallizes with difficulty in warm weather, but I have succeeded in obtaining two crops, one of them presenting the form of the oblique rhombic prism, and the other a very deeply-modified variety of the same. These crystals have the changeable purple color peculiar to the salts of chrome, and their solution in water is of the same hue while cold, but becomes green when heated.

This salt fused at about 98° F. into a deep green fluid, which began to assume the solid state when cooled to 75°, the thermometer rising thereupon to 96°. If heated to redness, it under-

goes complete decomposition, leaving a bulky oxide of a beautiful green color.

The composition of nitrate of chrome was found by analysis to be,—nitric acid 39·7 p. c., oxide of chrome 19 p. c. Calculation from the formula $3(N,0_5)Cr,0_3+18$ H, gives—nitric acid 40·44, sesquioxide of chrome 19·13, water 40·43.

No experiments have been made on the basic salts.—[*Silliman's Amer. Jour. for Jan.* 1850.]

TRANSACTIONS OF THE SOCIETY OF ARTS.

JAN. 30TH, 1850.

A paper by MR. HEATON, *on the cause and prevention of oscillation in locomotive engines, was read.*

The author, in the commencement of his paper, directs attention to the necessity and importance of adhering to the natural laws of motion, which cannot be transgressed without loss and inconvenience, and professes to place an old principle in a new light, rather than to lay claim to any new discovery. As an example of the mode adopted by nature to prevent shocks and oscillation —by causing the movement of one weight to be counterbalanced by the movement of another weight—he referred to the motion of the arms and legs in walking, and stated that he proposed to apply this principle to the prevention of the oscillation of locomotive engines. As the speed of railway trains was augmented, the liability of the engine to leave the rails was increased. To obviate this, heavier engines were used; and in many instances the engines and carriages were screwed tightly together, so as to form a rigid bar, and to distribute the weight more equally along the whole train. This, to a certain extent, steadied them, but the oscillation was not entirely got rid of.

The author then mentioned two or three accidents which have occurred from the engines jumping and getting off the rails.

After making experiments, Mr. Heaton ascertained that the oscillation and jumping of the engine arose from the action of the piston and gearing. This was very clearly shewn to the meeting by means of a model, representing the working parts of a locomotive engine, made to a scale of one-eighth the full size. It consisted of a strong rectangular frame of wood, mounted on suitable legs, and carrying at its centre a horizontal axle (to represent the driving axle of a locomotive engine) with a wheel fixed on it near each end thereof; a crank on each end of the axle was connected by a rod with a substitute for the piston-rod and piston, consisting of a horizontal bar, furnished with two wheels or rollers, which worked to and fro between two horizontal guides; and there was another crank on each end of the axle, which was connected at times by a rod with a piece of metal, corresponding in weight with the weight of the bar and its pair

of wheels, and carried by a kind of parallel motion.* By means of a winch and multiplying gear, the axle was made to revolve at a speed corresponding to the travelling of a locomotive engine at 40 miles per hour; and then, from the concussions which took place as the crank passed the "dead points," the frame was caused to vibrate laterally at each end alternately—which vibration or oscillation, in the case of a locomotive engine travelling along a railway at a high speed, would have a tendency to throw it off the rails.

It had been suggested to Mr. Heaton whether, by attaching a weight to the inside of that portion of the tire of the driving-wheel which, when the piston is at the furthest point in the cylinder, would be directly opposite to it, the same results might not be obtained. Mr. H. tried it, and found that oscillation was, to a great extent, prevented; but a new and equally detrimental effect was produced; as at each revolution of the wheel, when the weight was at its highest point from the rail, it had a tendency to fly from the centre of motion, and a lifting or jumping action took place. This he illustrated by fixing a weight to the wheels of the model in the positions just mentioned; and the effect was nearly to prevent the vibration or oscillation; but the frame had a slight jumping motion. He then took off the weights from the wheels and connected the second crank with the rod attached to the weight before mentioned (which weight could move freely to and fro in a horizontal or nearly horizontal direction); and, on the axle being caused to rotate with great rapidity, the effects of the alteration were immediately evident,—the frame remaining perfectly firm and immoveable.

After Mr. Heaton's paper and illustrations, the following paper was read:—

On an apparatus for aiding the drivers of locomotive engines in cases of danger, and for preventing collisions on railways; by Mr. C. F. Whitworth.

The author proposes that each locomotive engine shall carry two pendent rods, about six inches long, moving freely on axes, and acting on triggers. These triggers release two rods, each connected with levers which open their respective valves. One valve admits steam to an alarm-whistle, and the other admits steam into a small cylinder beneath a piston, which, rising, causes the lever of a throttle-valve to shut off the steam in the dome of the engine, The piston-rod of this small cylinder, at the same time that it shuts the throttle-valve, applies a lever-brake to the wheels of the locomotive engine, and also registers that to have been effected mechanically which the vigilance of the driver, under

* This will be more readily understood on referring to page 97, of our present Vol., where a description of the invention, as specified under a patent obtained by Mr. Heaton, is given.

ordinary circumstances, would have superseded, by his obeying the signal to shut off steam and apply the brakes before the train arrived at that part of the line where the apparatus would be put in action. The trigger-rods are acted upon by inclined planes of wood, placed parallel with the rails, and a few inches from them laterally. These rods are about four feet long, having hinge-joints at one end, and are capable of an elevation of four or five inches at the other. This elevation from a horizontal position is, in general, produced by a partial rotation of a transverse spindle, placed under the rails, and carrying two cams, which, acting by pressure under the inclines, cause them to assume the elevation requisite. The rotation of the spindle is produced by a motion of the lever and wire-rope which sets the distant signal; and the cams and lever on the spindle, together with weights for reaction, are so arranged as to cause an elevation or depression of the inclines in perfect accordance with the indication of the signal.

It should be remarked, that when the driver shuts off the steam himself, in accordance with the signal, this action lifts out of gear the trigger-rod, which would otherwise come in contact with the inclines; and that he cannot admit the steam to the cylinders without having replaced the rod. A dial and pointer is connected by a suitable arrangement of wheelwork with the other parts of the apparatus, so as to register the number of times that the apparatus has been brought into action, and, consequently, the number of times that the engine-driver has neglected to shut off the steam and apply the brakes when he ought to have done so.

February 6th.

The second part of a paper by Mr. A. G. Findlay, M.R.G.S., *on artificial breakwaters, and the principles which govern their construction, was read.*

Mr. Findlay commenced the second part of his paper by recapitulating some of the forces and circumstances to which breakwaters are subjected, as cited in the former abstract. The application of these was the subject of the present portion.

The preparations for the great Cherbourg *digue* were noticed; the proposals of 1712 and 1777 for a line of sunken ships, filled with masonry, as at the siege of La Rochelle, in 1573, and the first operations by M. de Cessart, in 1782-4, were described. This latter plan was to sink truncated conical caissons, strongly framed of timber, 150 feet in diameter, and 64 feet high, floated by means of a double tier of immense casks around their bases. The first and second was successfully launched; but, before the latter could be filled with stones, as intended, a storm carried it away to low-water mark. This led to a great change in the plan;—instead of 90 of these cones tangent to each other, they were to be placed at considerable distances apart,—the intervals to be filled with *pierre perdü*. 18 of them were laid; but they were all destroyed, but one, before 1789,—some of them in two

days after their being placed. The method *à pierre perdû* was then resorted to, and carried on until it was modified by an upright parapet from low-water level by M. Dupare, 1832: the work is still in progress.

The series of four different slopes, in which the waves have distributed the stones of the *digue*, was described; and the absence of the lowest slope in the Plymouth Breakwater was accounted for by the increased force of the waves upon the latter.

The commencement, in 1811, by Mr. Rennie, and subsequent proceedings under its present superintendent, Mr. Stuart, of the Plymouth Breakwater, were then noticed; and the increased length of foreshore which had been found necessary, from the original design, and the greater effect of the sea at its *west* end, were described. In 1838, on account of the great effects of a storm, a species of buttress was designed by Mr. James Walker, C.E., for the protection of the base of the lighthouse. This involved a new principle in hydraulic architecture, afterwards alluded to. This structure resembles, in some degree, the system of dovetailing and grooves adopted by Smeaton in the Eddystone; but differs in its application. The Delaware Breakwater in the United States was then briefly noticed.

The principle of presenting a concave face to the waves was also adverted to. In 1734 such a section was proposed, but not acted on, by M. Touros, for St. Jean de Luz. In 1787-95, Don Tornas Munos constructed the sea-walls of Cadiz thus: a straight foreshore of timber planking and a curved masonry termination. This was destroyed by the blocks of stone, placed at its foot for protection, rolling up the incline against the masonry. M. Emy, who endeavoured to establish the existence of what he denominates the *flôt-du-fond*, proposed a cylindrical or other curvilinear face for this purpose in 1818; and in 1820 he repaired the works of the fortification of St. Martin, Ile de Ré, in the Bay of Biscay, on his plan, which was so far successful, though not very greatly exposed. Various forms of the concave *revêtement* were noticed, and the natural form assumed by the shingle beach was cited as an instance of the effect of beach surf. This form has been adopted in the Dymchurch wall, constructed by Mr. Walker. The mode of action of the waves against a cliff was also explained, as producing a similar section.

Mr. Scott Russell's deductions from the wave system, leading also to similar conclusions, were then alluded to, and the sectional form he has proposed was described. He preferred a paraboloidal curve for the foreshore; and an over-hanging coping, so as to turn the wave on itself. Mr. Russell, for deep-water structures, preferred the method *à pierre perdû*, forming a straight foreshore. One objection to this system of concave face was, the varying level to which such structures are exposed from tidal influences, and the differences of curve presented at different periods of tide.

After these systems, the vertical or nearly vertical wall was described; and the great national work at Dover, the Refuge Har-

bour, was stated to be on the principle established by the experience of the buttress at the west end of Plymouth Breakwater. This mode of construction, found effective at that place, counteracts some of the difficulty met with in securing the masonry facing of it. In a previous part of the paper it was stated that the stones were blown out of the facing, or towards the sea-wave. This action is attributed to the percussion force entering the joints; and thus the water or air contained within the body of the masonry, being most forcibly driven upwards and outwards, carried single stones out of their beds. The new mode consists of stepping one course of stones into the upper surface of that beneath it, so as to form a ledge to prevent its outward tendency, and also to divert the direct action of the wave on the joint. In addition to this, each stone is so dove-tailed on its horizontal plane, that each course forms virtually one stone; and alternate stones in each course are locked into the course beneath it; so that, throughout the fabric, some portion of each course belongs to the one on either side of it, making the whole into one mass. These stones are formed at the quarries, and are fixed in their places by the diving-bell. The situation of Dover Harbour, as being free from the chances of silting up, was considered in reference to the tides, and the improbability that any great amount of shingle would, for the future, embarrass the work.

After Mr. Findlay's paper, one by Messrs. Staite and Petrie, *on improvements in the electric light*, was read, and illustrated by the exhibition of the electric light.

The following is an abstract of the paper:—

Of all artificial lights, that produced by electricity is the most beautiful, pure, and perfect, and only inferior to that of the sun itself. The difficulties involved in its production are manifold, the chief difficulty being to keep the electrodes at the proper distance asunder; and this, it was stated, had been overcome by the inventors' electro-magnetic regulator (placed on the table, and explained in action), which is self-regulating and not easily deranged.

The carbon used by the inventors is almost chemically pure, of an exceedingly equal structure and homogenity, and, by a simple process, has been obtained at a very insignificant expense. The conducting power of carbon is only $\frac{1}{2000}$th part that of copper; but, by peculiar arrangements, Messrs. Staite and Petrie have succeeded in supplying their lamps with electrodes for any definite number of hours.

By experiments, the inventors have determined formulæ, which yield, not merely comparative but direct quantitative results as to the relation of the *quantity* of current-electricity to its *intensity;* and also, in any varying case, they give the proper power of the electro-motive elements, their number in series, the diameter of the electrode, the length and section of the wire used for the regulator, its proportions when formed (including the section for

the conducting wires according to the distance of the light from the battery), the power of the light produced, the limit within which the power of the battery may be suffered to vary, and many minor points—all these being determined by well-ascertained laws, and applicable to all possible modifying circumstances. Messrs. Staite and Petrie assert that electricity has been reduced to a system so accurate in detail as to be implicitly relied on in practice.

A battery has been constructed by them in which fluid communications between the cells is effected in such a manner as to allow of the battery being charged and discharged in two or three minutes, whilst the strength of the solution used is kept perfectly uniform for very long periods, without the possibility of any local action on the zinc, and requires no sort of amalgamation. Further and fuller particulars concerning this will, on a future occasion, be laid before the Society.

By repeated experiments, Messrs. Staite and Petrie have satisfactorily proved that liquid communication between the cells of a battery, if properly arranged, will not affect either the quantity or intensity of the current, as supposed by many, while, at the same time, it gives the facility of maintaining the power for any given period.

The peculiar economy which, by great concentration of action and high temperature with very little volume of heat, is obtained by the electric light, may be explained thus: the amount of radiant light increases in a vastly greater ratio than the increase of temperature. A diagram, exhibiting a series of curved lines, was produced, to shew the relative increments of temperature, both in radiant heat and light, from a solid body. As far as experiments have gone, radiant light increases as the sixth power of the excess of temperature above 960° Fahrenheit. If, then, it is very expensive to maintain a given light by keeping a substance at a small increase of temperature beyond incipient luminosity, it will be far less expensive to obtain the same amount of light from a diminished illuminating surface, with a proportionately increased intensity of illumination; because the surface may be diminished in a far greater proportion than the current of electricity, required for the reduced surface, must be increased to give the proportionate increase of light. Hence the proportion of luminosity for the given current producing it becomes exceedingly high where the heated surface is so concentrated, as in the case of the tip of the electrode, or rather the spot occupied by the disruptive discharge. The problem of rendering light from electricity continuous and economical has been solved. It has been already introduced by the Barge Steam Towing Company, and is in constant use in the Enterprise tug-boat, where it is managed by the engineer on board without difficulty or failure. By the use of this light in houses, &c., all currents of vitiated air and gas are avoided, and a cool, pure, and perfectly shadowless light is secured.

Scientific Adjudication.

GUILDHALL.—*Before the Lord Chief Baron and a Special Jury,*
February 25th, 1850.

EDWARDS AND ANOTHER *v.* DA COSTA AND ANOTHER.

THIS was an action for the alleged infringement of a patent, granted to Mr. Downes Edwards on the 8th August, 1840, under the title of "improvements in preserving potatoes and other vegetable substances;"* by which process, potatoes were first rendered available for permanent use as ships' stores and for other purposes. Mr. Edwards subsequently entered a disclaimer in respect of the application of his process to any other vegetable matters than "potatoes which had been partially or entirely cooked."

The Attorney-General, Mr. Martin, and Mr. M. Smith, conducted the case for the plaintiffs; and Mr. Cockburn, with Mr. Hindmarch, appeared for the defendants.

The defendants pleaded the general issue, denying, first, that Her Majesty had granted the patent in question to the plaintiffs, or either of them; then, that the plaintiff was not the original inventor of the process specified; and then, that the invention had neither novelty nor utility.

It appeared from the statement of the learned counsel for the plaintiffs, that one of those gentlemen had for some years been occupied in the attempt to discover a means whereby potatoes might be preserved so as to make them available for use in the maritime service. It had long been a source of regret that no process was known for enabling potatoes to be used as a food during long sea voyages, and it had been admitted by all men of science, as well as by the first medical authorities of the age, that if any means could be ascertained by which such an end could be effected, the discovery would be of great service to mankind. Potatoes were known to be one of the most powerful antidotes to the scurvy, a disease to which every class of seafaring people had in all ages been subject, especially when out on long voyages. The terrors of the disease, the learned counsel stated, had some years since formed the object of an investigation in that court, when it had been proved that, in consequence of a particular vessel having been but badly provided with lime juice, the ship's crew had been attacked in the most frightful manner by scurvy. At that period, and indeed down to the date of Mr. Edwards' discovery, the only specific for or alleviation of this disease had been the partial use of lime juice as an article of diet. Many and anxious, however, had been the endeavours to obtain a means of "preserving potatoes;" for, although certain quantities were taken out as "ship's stores," still there were two difficulties which could not be overcome—namely, their bulkiness, and, above all, the positive certainty that they would

* For description of this invention see Vol. XXI., p. 422, Conjoined Series.

quickly decompose and become putrid, and thus be totally unfit for food. At length, Mr. Edwards, having made his discovery, secured it by a patent, (which it was now alleged had been infringed by the defendant) and the fact was no sooner divulged that potatoes could be "preserved" by that patent, and thus made available and merchantable for sea voyages, than the article was submitted to the test by Her Majesty's Lords of the Admiralty and the Victualling Board, by the East India Company, and by the leading shipowners. The result of those tests had been the attainment of the most perfect success, and from that time "Edwards' preserved potatoes" had been ordered to be made one of the ship's stores by the above authorities, and also by the Emigration Board,—whilst the most beneficial effects had accrued to the numerous crews and sea passengers from its use. Having thus established the utility of his invention, the patentee was not long permitted to enjoy the advantages of his patent without interruption; for, in the course of the year 1847, he ascertained that the defendants had put forth an article very closely resembling in appearance that which he had patented. The learned counsel then entered into a detailed description of the process employed under the patent of the plaintiffs, and as an illustration of the effective result of the discovery, caused a small quantity of the preserved material to be put into the requisite quantity of boiling water, which, having been covered over for 10 minutes, was then stirred up, and presented the appearance of fine mashed potato.

The potato disease rendered Mr. Edwards's patent more valuable, and induced many persons to adopt various schemes for preserving potatoes. In 1847, Messrs. Davison and Symington applied for and obtained a patent for desiccating vegetable substances, and the defendants, Messrs. Da Costa and Tanqueray, acting under a license from these patentees, produced a substance so nearly resembling that manufactured by the plaintiffs under their patent, as to make the present proceeding necessary in order to assert the plaintiffs' patent rights.

A large body of witnesses were in attendance in support of the case for the plaintiffs. Mr. Cooper, the well-known practical chemist, entered into a history of some experiments he had made with Professor Brande—first, on the "preserved potato" which was the result of the plaintiffs' patent, and then with the process which had been pointed out in *Forsyth* as that of a Frenchman of the name of Grenet, patented in 1796. Forsyth's book was published in 1804. In the former case the experiments were most successful, producing a perfectly dried and preserved article; but in the latter they found the produce to be of bad color, that it would not perfectly dry, but became mouldy, and totally unfitted as a merchantable article. The witness went into a very interesting detail of the two processes, and their progress and results; and proceeded to state, as did all the other witnesses on this side of the case, that they had never heard of any discovery having been made and carried out in practice for the

"preservation of potatoes," until the patent of Mr. Downes Edwards had been brought into operation.

Sir W. Barnett, the Director-General of the Medical Department of Her Majesty's navy, said, that, although he had been between 54 and 55 years in the medical department, he had never, until this patent of the plaintiffs', heard of any successful attempt to preserve potatoes so as to make them available for the purposes of "ships' stores." It was a valuable article as a preventive of scurvy. That was a disease which had until late years very generally existed in the navy, but he believed that down to a still later period it had been very prevalent in the commercial navy. Edwards' preserved potato had been tested, and found to bear out what had been said of it; and having been subsequently introduced as a store into the navy, it was found to be a very useful and valuable article of diet.

Professor Brande confirmed the statement of Mr. Cooper, and went on to add that the red potatoes (the "cup potato") contained the largest amount of nutritive matter, and that he had tested the good and the dark coloured article with a view of ascertaining whether the latter had deteriorated in nutritive value. He had found that there was no deterioration in that respect. This was a most valuable discovery, and he had never, until it had been put forth by the plaintiffs, heard of anything of the sort.

Dr. Miller, the Professor of Chemistry at King's College, also spoke of the utility and novelty of the patent.

Lieutenant Lean, the government emigration officer for the port of London, Mr. Lewis, the chemical lecturer at the Westminster Hospital, Dr. Robertson, and some others, also gave evidence as to the utility of the invention.

On the part of the defendants, it was urged by Mr. Cockburn that the process used by the plaintiffs was well known for many years antecedent to the year 1840, and that it was minutely and accurately described in *Forsyth's Book on Agriculture*, printed and published so far back as the year 1804. In that work the author not only described his own plan, but also that of a M. Grenet, a native of Geneva, who had some years before invented a plan nearly similar in substance, but which only enabled the experiment to be tried on a small scale,—and it had subsequently appeared in the *Encyclopedia Britannica*.

In confirmation of this view, Professor Phillips, and other scientific witnesses, were called, who stated that the plan for which the plaintiff obtained his patent was similar to that described in Mr. Forsyth's book, although the process was somewhat different.

Models of the process used by both plaintiffs and defendants were exhibited in court, and the experiment tried in both cases with a small quantity of potatoes dressed by steam, so that all moisture was got rid of, and, by being highly heated, without burning, a substance was produced like rice, which might be ground into flour. The specimens produced in court were tested, both by the Lord Chief Baron and the jury, and appeared to afford entire satisfaction.

The Lord Chief Baron, in summing up, informed the jury that it was not because something similar had been previously obtained by experiment that the plaintiffs' patent was rendered invalid. The evidence certainly was that the plaintiffs' method of preserving potatoes was substantially like that disclosed and explained by Mr. Forsyth nearly 50 years ago; but still, if the jury considered that the process by which the vegetables were preserved was different in its combination, though no part was positively new, and that the method adopted by the plaintiffs was an improvement, they would be justified in upholding the plaintiffs' right, and finding a verdict for them with nominal damages.

The Jury, after a consultation, returned a verdict for the plaintiffs, damages 5*l.*, thus establishing the validity of the patent.

The defendants' counsel tendered a bill of exceptions to the summing up of the Lord Chief Baron, upon which some discussion took place. The exceptions were ultimately reduced to a form to which the Lord Chief Baron expressed himself willing to attach his signature.

COURT OF COMMON PLEAS.

GUILDHALL.—*Before the Lord Chief Justice Wilde and a Special Jury.*

25th February, 1850.

THE ELECTRIC TELEGRAPH COMPANY V. BRETT AND LITTLE.

The Attorney-General, Mr. Martin, Q.C., Mr. M. Smith, and Mr. Grove, were counsel for the plaintiffs; and Mr. Cockburn, Q.C., Mr. Webster, and Mr. G. Chance, appeared for the defendants.

The subject of this action, which has occupied the court four days, is the means of transmitting telegraphic communications to distant parts of the kingdom, through the agency of electricity. There have been various mechanical contrivances for causing the electrical fluid to pass from a galvanic battery through wires to remote stations; and it is considered that the novel features of these mechanical contrivances constitute the subjects of the various patents which have been granted in reference to electric telegraphs, and not the principle itself, of passing the electric fluid through wires.

Several of these patents, principally those granted to Messrs. Cooke and Wheatstone, have become by assignment the property of the Electric Telegraph Company, the plaintiffs in this cause; and the defendants, Messrs. Brett and Little, are also patentees of certain modes of working electric telegraphs.

The action was brought to recover damages from the defendants, for an alleged infringement of a patent granted to Messrs. Cooke and Wheatstone, in the year 1847, under the title of "improvements in giving signals and sounding alarums in distant places by means of electric currents transmitted through metallic circuits."

The defendants in a great number of pleas denied *(inter alia)* that the invention claimed by the plaintiffs was new, or that they had infringed it. The instruments patented severally by the

parties were placed on the floor of the court, and were explained to the jury by the counsel and witnesses.

The Attorney-General, in opening the plaintiffs' case, said the present was the first of three actions which the plaintiffs felt compelled to bring to vindicate their right to certain patents of inventions upon which they had expended an immense capital, and which was of very great utility to the public. The defendant Little had been formerly in the service of the plaintiffs, and had thereby become well acquainted with their inventions; but upon leaving their service, he, in conjunction with Mr. Brett, took out a patent, which was a palpable infringement of those held by the plaintiffs.

It was not pretended in the specification of the plaintiffs' patent to claim the discovery of the principle of passing electric currents through wires; for they knew, as all persons acquainted with science must know, how from small beginnings and by slow degrees great inventions were perfected. In fact, Dr. Oërstead, a Dane, had ascertained as early as the year 1820 that the magnetic needle could be deflected and invested with an artificial polarity by a voltaic current. Subsequently, M. Ampère, a Frenchman, suggested, in an article written for a philosophical publication, that, by moving a number of needles by as many voltaic currents, and causing them to indicate signs, or the letters of the alphabet, a system of telegraphic communication might be established. It did not, however, appear that any means were taken to apply the principle of voltaic currents to practical use, until Messrs. Cooke and Wheatstone took out their first patent. In 1823, Mr. Ronalds published a pamphlet, in which he stated that he had tried experiments in the year 1816, as to the possibility of communicating signals by passing given numbers of electric sparks through an insulated wire, and that in this manner he had conveyed signals through a length of eight miles. Mr. Ronalds deemed this agency better than that of galvanic or voltaic electricity; but it was found, upon further experiments, that frictional electricity, as this was called, was not adapted to the purpose, on account of the tendency of the electric fluid to escape in all directions. Afterwards, a German, named Schweigger, suggested the plan of coiling the wires, by which means the electric current could be considerably increased.

This was the state of the discoveries on the subject up to the period of Messrs. Cooke and Wheatstone's invention. Their invention was founded upon the principles suggested by Oërstead, that as a natural stream of electricity passing round the circumference of the earth causes magnetic needles in general to be deflected at right angles to its course, or towards the north and south poles, so an artificial stream of electricity of adequate strength would cause magnetic needles, placed within its influence, to be similarly deflected. For example,—if a voltaic current were created in an ordinary voltaic battery, and a metallic wire were laid down, suppose between London and Birmingham,

and a magnetic needle were placed near to any part of the conducting wire, the transmission of an electric current from the voltaic battery would cause the needle to change its position so as to stand during the continuance of that current at right angles to the wire; being turned in one direction or the other, according to the course of the current. If, therefore, at each terminus there were placed an apparatus having a dial-plate with signals upon it, different motions of the needles might be made to constitute different signals. In order to secure a proper position for the indicator, the plaintiffs invented magnets, which they termed astatic needles, by the influence of which the needle was kept in a vertical position until acted upon by the voltaic current. What was wanted, however, was, the means of securing—that instantly after the communication of the current to it, the needle should be fixed, so that the indication by it should be certain; and this they accomplished by means of two fixed stops. But perhaps the greatest and most useful portion of their invention was this, that by inventing moveable bridges or cross-bars (a simple process to break the chain of communication) the apparatus was made capable both of giving and receiving signals at the same time at each terminus, or at the intermediate stations; so that the person in London who sent a signal to Birmingham was able at the same time to see whether the apparatus at Birmingham communicated the proper signal, and *vice versâ*.

The original suggestion of Messrs. Cooke and Wheatstone was to have five circuits and five needles, but it was afterwards found that the apparatus could be worked almost equally well with a smaller number. After the plaintiffs had first patented their invention, they improved it from time to time, and took out other patents for these improvements in the years 1838 and 1842. Of the invention thus perfected the principal features were five, viz.:—The mode in which the same apparatus was rendered capable of either giving or receiving signals; the mode in which the galvanic circuit was alternately broken and completed at either end, according to the direction in which intelligence was to be conveyed; the mode of communicating with intermediate stations; the balancing of the needles in a vertical position, so that they should remain upright; and the placing of stops on each side of the needles to prevent their being deflected beyond a certain point.

The instrument patented by the defendants, and now complained of by the plaintiffs, was substantially the same as the plaintiffs' invention,—the principal difference being, that whereas the plaintiffs made use of straight needles, the defendants used magnets of the shape of a segment of a circle, with pointers attached to them;—the mode of action however being precisely the same. The defendants' apparatus was also worked by one wire only; but he believed, although this was not the original intention of the plaintiffs, their apparatus could also be worked by one wire; so that in reality the defendants had no claim, in this respect, to the merit of a new invention.

In support of the plaintiffs' case, Mr. Carpmael was called, who stated, that prior to the invention patented by Messrs. Cooke and Wheatstone, there was nothing that could be properly called an electric telegraph. He then explained the discovery of Oërstead, and the suggestions of Ampère, Ronalds, and Schweigger, and also explained to the jury, from the instruments in the court, the invention claimed by the plaintiffs, and the mode of using it. In his opinion, Messrs. Cooke and Wheatstone had most fully and accurately described the invention in their specification. He thought it was a novel and very useful invention, and also that it had been clearly infringed by the defendants.

Mr. Cowper, of King's College; Mr. Hatcher, engineer to the company; Mr. Farey, civil engineer, who drew the plaintiffs' specification; and Mr. Miller, of King's College, also testified to the novelty and utility of the plaintiffs' invention, and to the manner in which it had been infringed by the defendants.

Mr. Cockburn, Q. C., then addressed the jury for the defendants, and said he quite agreed as to the importance of the invention patented by the plaintiffs; but the jury must not be led aside by that consideration to suppose that the plaintiffs had suddenly discovered something which had not been suggested by previous inventions. Almost all inventions were the result of gradual advances in science, and it was impossible, as respected this invention, not to see but that Messrs. Cooke and Wheatstone had been largely indebted to Oërstead, Ampère, and others of their predecessors. Ampère's was the first practical suggestion on the subject; and the invention of Alexander, to which his learned friend had not referred, was the immediate predecessor of the present invention. In fact, there could be no doubt that but for Alexander's invention Messrs. Cooke and Wheatstone would never have brought their telegraph into practice. The practical difference between them was simply this—that in Alexander's the needle in its deflection touched a screen, which covered a letter, and thereby exposed it; and in Cooke and Wheatstone's patent of 1837 (the patent in question), the letters were not concealed, but were pointed to by the needle in its deflection.

The question for the jury was, had the defendants infringed that patent? They must remember that in that action they were dealing with the original patent, and had nothing to do with subsequent improvements; for if the defendants had infringed any subsequent patents they would be answerable in other actions. As to the invention before them, he observed that, by the specification, the first thing claimed was the use of astatic needles, so as to make the indicators vertical. Now, the defendants did not use astatic needles, nor did they load their needles like the plaintiffs. The defendants used a magnet ring, and not a needle, except at the end as an indicator. Then was there any novelty in the coils used by the plaintiffs? It was admitted these were known before, but it was said the plaintiffs made their needles perpendicular, in a vertical plane, and to act at right angles to the coils. Be it so; the defendants' needles moved in a direc-

tion parallel to the coils, and, the power being thereby concentrated, the apparatus could be worked at much less expense, and with greater certainty. Then again, the plaintiffs operated with five needles, five wires, and an additional sixth wire, to complete the galvanic current;—the defendants used one wire only. The plaintiffs now said they could operate also with one or two. Yes, but did they contemplate it in their specification? The plaintiffs' mode of working was to make the needles point to the signal letter; the defendants' plan was entirely different; for their mode of operating was to indicate, by a number of deflections, the particular signal wished to be communicated. According to the plaintiffs' patent, there must be one more wire than the number of needles; but by the defendants' patent one wire only was necessary; and thus four-fifths of the expense to which the plaintiffs put the public was saved to them by the defendants. Then the plaintiffs claimed as their invention the cross-bars to break the chain of communication, and keys with which to operate upon the wires; but the jury should see that Alexander's invention, which he had referred to, had both, and that his apparatus was substantially the same as the plaintiffs'. He said, therefore, first, that the invention patented by the plaintiffs was not new; and, secondly, that if it were, the defendants had not infringed it; for, as he should prove to the jury, it was, as respected all that had not been known before, substantially different from the plaintiffs' patent.

Mr. Bain, the inventor of several telegraphs, and author of works upon the subject of telegraphic communication; and Mr. Heighton, electrical engineer to the London and North-Western Railway, were called on behalf of the defendants, and testified that in their opinion the invention of the defendants was very different, and of greater ingenuity and utility than the plaintiffs'.

The Attorney-General replied for the plaintiffs.

The Lord Chief Justice summed up the case very briefly. He explained to the jury that what they had to consider was, whether that which had been done by the defendants was a *bonâ fide* substantial improvement on the plaintiffs' invention, or a mere colorable alteration. The plaintiffs did not claim to be the discoverers of the principle of applying electric currents to the purpose of communicating sounds or signals. Their patent was avowedly for "improvements in giving signals, and sounding alarums in distant places by means of electric currents transmitted through metallic circuits." They had not, therefore, the same right to restrain improvements in working out the principle of applying electric currents as they would have had if they had discovered the principle itself. It was said, on the part of the plaintiffs, that all that the defendants had done was to copy their improvements by means of mechanical equivalents. Now no man has a right to build upon another's foundation, but equivalents are not necessarily shewn by similarity of effect being obtained. Whether the plaintiffs' patent, which was designed for a telegraph consisting of five needles and five wires, two at least of which

must be used in order to exhibit one letter, would embrace a telegraph worked by one needle and one wire, and which did not point to a letter, but indicated it by the number of deflections which it made, was a question which he would not decide to-day, but would reserve for the Court above; and if the Court should be of opinion that it did not embrace it, then he would reserve leave to have the verdict entered for the defendants. At the same time, he would ask the jury to say whether, in their opinion, the defendants' invention was substantially the same as the plaintiffs', or was only a colorable evasion of it,—the defendants pretending to make alterations, when, in fact, they were making the same thing. They had heard the manner in which the five wires were used. They had heard that it was by a convergence of two needles that the letters on the face of the dial were indicated, and that the whole five were essential. It was obvious that a telegraph using five wires was more liable to derangement than a telegraph using only one wire, and they had heard the difference in expense was great, being as much as 9000*l.* on the line between London and Liverpool. His Lordship then went very briefly and cursorily through the several points on which it was said the defendants had infringed on the plaintiffs' patent, and left a question on each point to the jury; remarking, in relation to the evidence adduced, that there was not so much reliable information to be obtained from scientific witnesses as could be desired, for the bias with which their evidence was given, rendered it necessary that the jury should receive it with great caution.

At the close of the summing up it was arranged that Mr. Cockburn should have leave to move for a new trial, or to rely on a bill of exceptions on the two following points:—First, whether, considering the plaintiffs' patent to be based on transmitting electrical currents over a continuous metallic circuit, the defendants' adoption of any portion of the plaintiffs' process to electrical currents passed over a circuit of which the earth forms a part, instead of a continuous metallic circuit, was an invasion of the plaintiffs' patent; and, second, whether the plaintiffs' patent, being based on a system that worked by five wires and five needles acting on a dial, on which the letters of the alphabet were indicated, and to which letters one or two needles was or were intended to point, was invaded by a system that had one wire and one needle that was not intended to point out to any particular letter, but indicated each letter by the number of deflections which it made to the right or to the left, or to both in succession.

After the jury had been in consultation for upwards of an hour, it was arranged between the counsel that a verdict should be taken for the plaintiffs on all the issues excepting "not guilty,"—this being taken to include all the specific questions left to the jury. On returning into court the jury gave the following as the substance of their findings: That the making of signals at distant stations was a new invention of the plaintiffs; that so also was the sending of signals to intermediate stations; and so also was the angular motion of the needles on vertical planes and horizon-

tal axes conjointly with stops;—that the plaintiffs' use of the dial was not new; that the handle of the defendants, operating for the purpose of changing the circuits, was not an imitation of the cross-bar of the plaintiffs, but a different instrument acting on the same principle; that the magnetic ring and indicator of the defendants was a different instrument from that mentioned in the plaintiffs' specification; that the indication of the same signals at the same time at distant stations was not the plantiffs' invention; that the defendants' instrument using one wire and two needles was not the same as the plaintiffs'; and that the system of the telegraph was a different system from the plaintiffs'.

His Lordship directed the verdict to be entered for the plaintiffs, damages £5, with leave for the defendants to move on the points first reserved, and also on the effect of the findings of the jury, to have the verdict entered for them.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Jan. 29. *James Finlayson*, of Johnstone, for a thread finishing or polishing machine.

29. *Charles Leesley*, of 9, Orchard-lane, Sheffield, for a back for a razor blade.

31. *François Van Der Brande*, of 12, Bedford-street, Bedford-square, for an extending loo table.

31. *George Houghton*, of Birmingham, for a college cap.

Feb. 2. *John Sanders*, of Birmingham, for a door knob.

4, *David Mather*, of Dundee, engineer, for an automatic blow-off apparatus and salinometer for marine steam-boiler.

6. *Langman, Ward, & Co.*, of Wolverhampton, for a burner for burning luxurine or other spirit.

6. *Thomas Wharton*, of Birmingham, for an inkstand.

6. *Henry Hopwood*, of Scarborough, for a portable mangle.

6. *J. & E. Ratcliff*, of 58, St. Paul's-square, Birmingham, manufacturers, for "the universal reservoir inkstand."

7. *Josiah Sims*, of Tavistock, for improvements in the oven of the domestic cooking stove.

8. *Louis Rodolph Bodmer*, of 11, Ducie-place, Manchester, engineer, for an improved door-spring.

8. *Martin, Baskett, & Martin*, of Cheltenham, jewellers, for "the porte-fleur brooch."

9. *Cope & Collinson*, of Summer-row, Birmingham, and No. 53, Berwick-street, Oxford-street, London, brass-founders, for an improved bracket for Venetian blinds.

9. *John Lingard*, of Pea Croft, Sheffield, for a pocket knife.

9. *Scott & Thompson*, of 75, Upper Ground-street, Blackfriars-bridge, London, iron and brass-founders, for an improved ladle for pouring melted metallic and other substances.

Feb. 11. *W. Kidston & Co.*, of Bishopsgate-street Without, London, for an instrument or apparatus for drawing blood.

12. *William Brooksby Crabb*, of 22, Motcomb-street, Belgrave-square, for "the Accelero clasp."

12. *John St. Quentin*, of Norwich, for a water-closet.

12. *J. J. Wilson*, of Arundel-place, Haymarket, for an improved brush.

13. *Enoch Oldfield Tindall & Lorenzo Tindall*, carrying on business as ironmongers under the style or firm of *E. O. & L. Tindall*, of Scarborough, Yorkshire, for an improved mangle and wringing machine, with horizontal spring pressure.

15. *Samuel Hiron*, of Birmingham, for a press for embossing and other purposes.

16. *Thomas Wells Cross*, of Leeds, Yorkshire, for a barrel with grooved and tongued staves.

18. *Anthony Mayer*, of Savage-gardens, Tower-hill, civil engineer, for a sawing instrument.

20. *John Sanders*, of 71, Wood-street, Cheapside, London, for an umbrella tent.

21. *John Broadfoot*, of Glasgow, for water-closet valves.

22. *William Simons*, of Greenock, ship-builder, for a telescopic tiller.

22. *David Stephens Brown*, of Old Kent-road, Surrey, for an improved thermo-barometer.

22. *Thomas Warren*, of 371, Oxford-street, London, for a reading stand.

22. *Joseph Wood*, of 28, Spurrier-gate, York, surgical instrument maker and cutler, for a razor.

23. *E. Moses & Son*, of Aldgate and Minories, London, clothiers, &c., for "the registered strap for trousers."

23. *William Hancock*, of 10, Cross-street, Islington, for an elastic safety-pocket or *garde-poche*.

25. *William Williams*, of High-street, Bedford, and *Samuel L. Taylor*, of Cotton End, near Bedford, for an improved chaff-cutter.

25. *Luke Marshall Hill*, of Whitby, Yorkshire, tailor and habit-maker, for "the habit unique."

25. *David Stephens Brown*, of Old Kent-road, Surrey, for a hinged label.

25. *Biffen & Son*, of Hammersmith, for a portable wager boat.

25. *Alexander Symons* and *Alexis Soyer*, carrying on business under the Firm of A. Soyer & Co., of 5, Charing-cross, Middlesex, for "the magic stove."

25. *Thomas Nixon*, of Kettering, Northamptonshire, for a metallic ventilating skylight or garden sash-frame.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th January to the 17th February, 1850, inclusive.

To Alexander Swan, of Kirkaldy, in the county of Fife, manufacturer, for improvements in heating apparatus, and in applying hot and warm air to manufacturing and other purposes where the same is required.—Sealed 28th January.

Jacques Hulot, of Rue Saint Joseph, Paris, in the Republic of France, manufacturer, for improvements in the manufacture of the fronts of shirts.—Sealed 1st February.

Thomas John Knowlys, of Heysham Tower, near Lancaster, Esq., for improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat.—Sealed 4th February.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals and alloys of metals.—Sealed 12th February.

List of Patents

Granted for SCOTLAND, subsequent to January 22nd, 1850.

To Joseph Clinton Robertson, of 166, Fleet-street, London, civil engineer, for improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating substances,—being a communication.—Sealed 23rd January.

William Thomas Henley, of Clerkenwell, London, philosophical instrument-maker, for certain improvements in telegraphic communication, and in apparatus connected therewith; parts of which improvements may be also applied to the moving of other machines and machinery.—Sealed 23rd January.

Christopher Nickels, of York-road, Lambeth, for improvements in the manufacture of woollen and other fabrics.—Sealed 24th January.

Ewald Riepe, of Finsbury-square, London, merchant, for improvements in the manufacture of steel,—being a communication.—Sealed 24th January.

Benjamin Thompson, of Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron.—Sealed 31st January.

Thomas Marsden, of Salford, machine-maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances.—Sealed 31st January.

Elijah Galloway, of Southampton-buildings, Chancery-lane, London, civil engineer, for improvements in furnaces.—Sealed 1st February.

Robert Fayrer, of Surrey-street, Strand, London, Commander, R. N., for improvements in steering apparatus.—Sealed 1st February.

Macgregor Laird, of Birkenhead, for improvements in the construction of metallic ships or vessels, and in materials for coating the bottom of iron ships or vessels, and in steering ships or vessels.—Sealed 6th February.

James Templeton, of Glasgow, manufacturer, for certain improvements in manufacturing figured fabrics, principally designed for the production of carpeting.—Sealed 12th February.

William Henry Green, of Basinghall-street, London, for improvements in the preparation of peat fuel, and in the mode of applying the products derived therefrom to the preservation of certain substances which are subject to decay,—being a communication.—Sealed 12th February.

Joseph Long and James Long, of Little Tower-street, London, mathematical instrument-makers, and Richard Pattenden, of Nelson-square, London, engineer, for an improvement in instruments and machinery for steering ships; which is also applicable to vices and other instruments and machinery for obtaining power.—Sealed 12th February.

James Mc Donald, of Chester, Coach-maker, for certain improvements in the mode of applying oil or grease to wheels and axles, and to machinery; and in connecting the springs of wheel-carriages with the axles or axle-boxes.—Sealed 13th February.

William Mayo, of the firm of Mayo and Warmington, Silver-street, Wood-street, Cheapside, London, manufacturers of mineral aerated waters, for improvements in connecting tubes and pipes and other surfaces of glass and earthenware, and in connecting other matters with glass and earthenware.—Sealed 13th February.

Henry Attwood, of Goodman's Fields, London, engineer, and John Renton, of Bromley, London, engineer, for certain improvements in the manufacture of starch and other like articles of commerce from farinaceous and leguminous substances.—Sealed 14th February.

William Furness, of Lawton-street, Liverpool, builder, for improvements in machinery for cutting, tenoning, planing, moulding, grooving, and sawing wood; also for sharpening and grinding tools or surfaces; and also in welding steel to cast-iron,—being a communication.—Sealed 15th February.

Sir John Mac Neill, Knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways.—Sealed 15th February.

Louis Napoleon Le Gras, of Paris, civil engineer, for improvements in the separation and disinfection of fecal matters in the manufacture of manure, and in the apparatus employed therein.—Sealed 21st February.

Matthew Cochran, of High-street, Paisley, for improvements in machinery for the production and ornamenting of fabrics and tissues generally; parts of which improvements are applicable to the regulation of other machinery, and to purposes of a similar nature.—Sealed 21st February.

Benjamin Goodfellow, of Hyde, in the county of Chester, engineer, for certain improvements in steam-engines.—Sealed 21st February.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, mechanical draughtsman, for improvements in manufacturing and refining sugar,—being a communication.—Sealed 22nd February.

Ernest Gaston, of the Erechtheum Club, St. James's, London, for certain improvements in artificial fuel, and in machinery used for manufacturing the same.—Sealed 22nd February.

New Patents
SEALED IN ENGLAND.
1850.

To Richard Roberts, of Manchester, engineer, for improvements in the manufacture of certain textile fabrics,—in machinery for weaving plain, figured, and terry or looped fabrics,—and in machinery or apparatus for cutting velvets and other fabrics. Sealed 29th January—6 months for inrolment.

Donald Beatson, of Green-street, Stepney, in the county of Middlesex, mariner, for certain improvements in instruments for taking, measuring, and computing angles. Sealed 29th January—6 months for inrolment.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, for improvements in the manufacture of steel,—being a communication. Sealed 29th January—6 months for inrolment.

Joel Spiller, of Battersea, in the county of Surrey, engineer, for improvements in cleaning and grinding wheat. Sealed 29th January—6 months for inrolment.

John Mason, of Rochdale, and Mark Smith, of Heywood, both in the county of Lancaster, machine-makers, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other textile materials; and also improvements in the method of preparing yarns or threads, and in the machinery or apparatus employed for such purposes. Sealed 29th January—6 months for inrolment.

Francis Edward Colegrave, of Brighton, Gent., for improvements in saddles; parts of which improvements are also applicable to the standing rigging and other furniture of ships or vessels, and to the connecting links or chains of railway carriages and other purposes where tension combined with a certain degree of elasticity are required. Sealed 29th January—6 months for inrolment.

James Templeton, of Glasgow, manufacturer, for certain improvements in manufacturing figured fabrics, principally designed for the production of carpeting. Sealed 29th January—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery or apparatus for making hat bodies and other similar articles,—being a communication. Sealed 29th January—6 months for inrolment.

Thomas Bury, of Salford, in the county of Lancaster, silk, worsted, and piece dyer and finisher, and Nathan Ramsden, of Salford, in the said county, calenderman and finisher, for certain improvements in the construction of machines for glazing, embossing, and finishing woven fabrics and paper,—being partly a communication. Sealed 31st January—2 months for inrolment.

Albert Dummler, of Mark-lane, in the City of London, for improvements in obtaining fibres from textile plants,—being a communication. Sealed 31st January—6 months for inrolment.

Etienne Joseph Hanon Valck, of the Kingdom of Belgium, miller, for improvements in grinding. Sealed 31st January—6 months for inrolment.

Edward Highton, of Clarence Villa, Regent's Park, in the county of Middlesex, engineer, for improvements in electric telegraphs, and in making telegraphic communications. Sealed 7th February—6 months for inrolment.

Charles Atherton, Member of the Institution of Civil Engineers, of London, for an improved apparatus or machinery for regulating the admission of steam to the cylinders of steam-engines. Sealed 7th February—6 months for inrolment.

Thomas Auchterlonie, of Glasgow, North Britain, manufacturer and calico printer, for improvements in the production of ornamental fabrics. Sealed 7th February—6 months for inrolment.

Edward Ormerod, of Manchester, mechanical engineer, and Joseph Shepherd, of Charlton-upon-Medlock, in the same county, mechanical engineer, for improvements in or applicable to apparatus for changing the position of carriages on railways. Sealed 7th February—6 months for inrolment.

Louis Jean Jacques, Viscount de Serionne, of Paris, Gent., for certain improvements in the manufacture of buttons; and in the apparatus and machinery used therein. Sealed 9th February—6 months for inrolment.

Bryan Donkin the younger, of Bermondsey, in the county of Surrey, civil engineer, and Barnard William Farey, of Old Kent-road, in the said county, civil engineer, for improvements in steam engines; and an improved fluid meter. Sealed 9th February—6 months for inrolment.

Read Holliday, of Huddersfield, for improvements in lamps. Sealed 11th February—6 months for inrolment.

William Blinkhorn, of Sutton, in the county of Lancaster, glass manufacturer, for certain improvements in machinery to be used in the manufacture of glass. Sealed 11th February—6 months for inrolment.

James Webster, of Leicester, engineer, for improvements in the production of gas for the purposes of light. Sealed 12th Februray—6 months for inrolment.

John Macintosh, of Berners-street, Oxford-street, civil engineer, for improvements in obtaining power in the floating of bodies, and in conveying fluids. Sealed 12th February—6 months for inrolment.

Thomas Whiffen, of Pigs Quay, Bridewell Precinct, accountant, for improvements in machinery for registering the delivery of goods. Sealed 21st February—6 months for inrolment.

John Stephen Woolrich, of Wednesbury, in the county of Stafford, chemist, John James Russell, of Handsworth, in the same county, and Thomas Henry Russell, of Wednesbury, aforesaid, patent tube manufacturers, for improvements in obtaining cadmium and other metals and products from ores or matters containing them. Sealed 21st February—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in separating and assorting solid materials or substances of different specific gravities,—being a communication. Sealed 21st February—6 months for inrolment.

John Slack, of Manchester, in the county of Lancaster, manager, for certain improvements in the manufacture of textile goods or fabrics; and in certain machinery or apparatus connected therewith. Sealed 21st February—6 months for inrolment.

Alexander Hédiard, of Paris, in the Republic of France, Gent., for certain improvements in propelling. Sealed 21st February —6 months for inrolment.

George Holworthy Palmer, of Westbourne Villas, Harrow-road, in the county of Middlesex, civil engineer, and Joshua Horton, of the Ætna steam-engine boiler and gasometer manufactory, Smethwich, near Birmingham, in the county of Stafford, for their invention of improvements in the arrangement and construction of gas-holders. Sealed 21st February—6 months for inrolment.

William Cormack, of 60, King-street, Dunston-road, Haggerstone, in the county of Middlesex, chemist, for improvements in puri-

fying gas; also applicable in obtaining or separating certain products or materials from gas-water and other similar fluids. Sealed 21st February—6 months for inrolment.

William Mayo, of the firm of Mayo and Warmington, Silver-street, Wood-street, Cheapside, manufacturers of mineral and aerated waters, for improvements in connecting tubes and pipes and other surfaces of glass and earthenware; and in connecting other matters with glass and earthenware. Sealed 21st February—6 months for inrolment.

John Scoffern, of Essex-street, Middlesex, M. B., for improvements in the manufacture and refining of sugar, and in the treatment and use of matters obtained in such manufacture; and in the construction of valves used in such and other manufactures. Sealed 21st February—6 months for inrolment.

Charles Andrew, of Compstall Bridge, in the county of Chester, manufacturer, and Richard Markland, of the same place, manager, for certain improvements in the method of, and in the machinery or apparatus for, preparing warps for weaving. Sealed 21st February—6 months for inrolment.

James Hall, of Geecross, near Stockport, in the county of Chester, machine maker, for certain improvements in looms for weaving. Sealed 25th February—6 months for inrolment.

Brereton Todd, of the Bank, Falmouth, Gent., for improvements in the manufacture of arsenic, sulphuric acid, and the oxide of antimony, from copper and other ores in which they are contained, and also the oxide of zinc. Sealed 27th February—6 months for inrolment.

George Gwynne, of Sussex-square, in the county of Middlesex, Esq., for improvements in the manufacture of sugar. Sealed 27th February—6 months for inrolment.

Matthew Cochran, of High-street, Paisley, in the county of Renfrew, N. B., manufacturer, for improvements in machinery for the production and ornamenting of fabrics and tissues generally; parts of which improvements are applicable to the regulation of other machinery and to purposes of a similar nature. Sealed 27th February—6 months for inrolment.

Julius Jeffreys, of Bucklersbury, in the City of London, Gent., for improvements in preventing or removing affections of the chest. Sealed 28th February—6 months for inrolment.

George Tosco Peppe, of Great Marylebone-street, in the county of Middlesex, civil engineer, for improvements in time-keepers. Sealed 28th February—6 months for inrolment.

George William Lenox, of Billiter-square, in the City of London, chain-cable manufacturer, and William Roberts, foreman to Messrs. Brown, Lenox, and Co., of Millwall, for improvements in working windlass and other barrels. Sealed 28th February—6 months for inrolment.

CELESTIAL PHENOMENA FOR MARCH, 1850.

D.	H.	M.	
1			Clock before the ⊙ 12m. 37s.
	—		☽ rises 9h. 53m. A.
	—		☽ passes mer. 2h. 25m. M.
	—		☽ sets 7h. 19m. M.
2			Occul. x^1 Libra, im. 17h. 10m. em. 17h 37m.
	4	12	☿ in the descending node.
	13	17	♀ in sup. conj. with the ⊙
4	13	16	♀ greatest hel. lat. S.
	23	9	☿ greatest elong. 27. 19. W.
5	8	5	☽ in □ or last quarter
	—		Clock before the ⊙ 11m. 45s.
	—		☽ rises 0h. 55m. M.
	—		☽ passes mer. 5h. 36m. M.
	—		☽ sets 10h. 12m. M.
	18	9	♃'s first sat. will im.
7	9	27	♃'s second sat. will im.
	20		☽ in Apogee
8	13	10	♃ in oppo. to the ⊙
10			Clock before the ⊙ 10m. 31s.
	—		☽ rises 4h. 59m. M.
	—		☽ passes mer. 9h. 34m. M.
	—		☽ sets 2h. 14m. A.
11	4	35	☿ in conj. with the ☽ diff. of dec. 1. 20. S.
12	8		☿ in Aphelion.
13	11	17	Ecliptic conj. or ● new moon
	15	42	♀ in conj. with the ☽ diff. of dec, 1. 29. N.
14			Mercury R. A. 22h. 2m. dec. 13. 48. S.
	—		Venus R. A. 23h. 49m. dec. 2. 41. S.
	—		Mars R. A. 5h. 58m. dec. 25. 55. N.
	—		Vesta R. A. 6h. 58m. dec. 26. 11. N.
	—		Juno R. A. 13h. 38m. dec. 2. 17. S.
	—		Pallas R. A. 21h. 0m. dec. 4. 56. N.
	—		Ceres R. A. 22h. 28m. dec. 17. 33. S.
	—		Jupiter R. A. 11h. 16m. dec. 6. 21. N.
	—		Saturn R. A. 0h. 35m. dec. 1. 24. N.
	—		Georg. R. A. 1h. 31m. dec. 8. 58. N.
14			Mercury passes mer. 22h. 36m.
	—		Venus passes mer. 0h. 21m.
	—		Mars passes mer. 6h. 30m.
	—		Jupiter passes mer. 6h. 21m.
	—		Saturn passes mer. 1h. 8m.
	—		Georg. passes mer. 2h. 4m.
	14	50	♃'s second sat. will em.
	16	44	♃'s first sat. will im.
	15	25	♄ in conj. with the ☽ diff. of dec. 1. 35. N.
15			Clock before the ⊙ 9m. 9s.
	—		☽ rises 7h. 13m. M.
	—		☽ passes mer. 1h. 25m. A.
	—		☽ sets 7h. 49m. A.
15	18	32	♅ in conj. with the ☽ diff. of dec. 4. 14. N.
16	11	13	♃'s first sat. will em.
19			Occul. a Tauri, im. 0h. 43m.
20	20		♂ in conj. with the ☽ diff. of dec. 6. 23. N.
21	3	58	☽ in □ or first quarter.
	17	27	♃'s second sat. will em.
22			Occul. 3 Cancri, im. 13h. 2m. em. 13h. 54m.
	—		Occul. 0^1 Cancri, im. 11h. 30m. em. 12h. 34m.
	—		Occul. 0^2, Cancri, im. 12h. 3m.
	9	56	♃'s third sat. will em.
	13	7	♃'s first sat. will im.
	15		☽ in Perigee
24			Ceres in Aphelion.
	14	22	♂ in □ with the ⊙
25			Clock before the ⊙ 6m. 9s.
	—		☽ rises 3h. 21m. A.
	—		☽ passes mer. 10h. 30m. A.
	—		☽ sets 4h. 54m. M.
	6	45	♃'s second sat. will em.
	7	52	♀ in conj. with ♅ diff. of dec.
	16	11	♃'s fourth sat. will im.
25	23	11	♃ in conj. with the ☽ diff. of dec. 0. 32. S.
27	11	26	Ecliptic oppo. or ○ full moon
28			Occul. 66 Virginis, im. 7h. 39m.
30			Clock before the ⊙ 4m. 36s.
	—		☽ rises 9h. 33m. A.
	—		☽ passes mer. 1h. 51m. M.
	—		☽ sets 7h. 10m. M
	13	54	♃'s third sat. will em.
31	10	32	♄ in conj. with the ⊙

J. LEWTHWAITE, Rotherhithe.

THE

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CONJOINED SERIES.

No. CCXX.

RECENT PATENTS.

To Thomas Beale Browne, *of Hampen, in the county of Gloucester, Gent., for an invention of certain improvements in looms, and in the manufacture of woven and twisted fabrics,—being a communication.*—[Sealed 29th June, 1849.]

The first part of this invention consists in certain arrangements of the loom, by which the batten is enabled to beat up the weft-thread or yarn several times without passing the shuttle, for the purpose of driving up or increasing the density of the fabric so woven; and also in placing, when desired, a bar or rod of wood, iron, or other suitable material, of a wedge form in section, between the open sheds of the warp, in order more intimately to drive home the last shoot or weft, and to open the shed free for the passage of the next weft. By these novel arrangements of the loom, a very firm cloth, canvass, or other fabric, may be produced.

The second part of the invention refers to the weaving of fabrics by the power-loom, in tubular forms, for hose or water-pipes. These tubes may be made of any required dimensions and of any suitable fibrous material, or an admixture of gutta-percha threads or strands therewith, or fibrous material coated with gutta-percha.

The third part of the invention refers to the manufacturing of sacks, bags, and such like articles; and consists in making sacks and bags in a peculiar way, in order that they may not require sewing together. This is effected by weaving them

somewhat in the manner in which the round lamp-wicks are commonly made, and, at the same time, rendering the bottom of such sacks or bags much stronger, and thereby enabling them to sustain better the wear to which they will be exposed.

The fourth part of the invention refers to the manufacturing of belts, separately or in broad sheets, to be afterwards cut into strips, to form bands for driving machinery. This manufacture is effected either by drawing hemp, flax, or other fibrous yarns, through gutta-percha, or a mixture of gutta-percha with other bodies, or by intermixing gutta-percha threads or strands with hemp or any other yarns composed of fibrous materials. When thus treated, the fibrous materials are woven together into separate belts or broad sheets, and they are afterwards brought into a compact mass by means of heat and rollers.

The fifth part of the invention consists in manufacturing ropes, by drawing strands or fibrous material through a heated mass of gutta-percha, and twisting together as in making ordinary ropes, or laying, longitudinally, the strands side by side, which may be then subjected to heat and pressure, in order that the rope may become one compact mass, capable of resisting, in a great measure, damp and wet.

The first part of this invention, viz., the loom for weaving broad goods, such as sail-cloths, or other fabrics which require the weft to be firmly beaten up, is shewn in Plate VII.; fig. 1, being a front elevation of part of the loom, with its improved appendages; and fig. 2, an end elevation of the same, taken at the right hand of fig. 1. A, A, is the main framing of the loom; B, the breast-beam; C, the lay; D, D, are the lay swords; E, E, the warp-threads; F, is the driving-shaft, which is actuated by steam or any other power; and G, shews the fast and loose pulleys. The castle, with the figuring apparatus (not shewn in this figure), is placed at the upper part of the loom. This part is represented detached and upon an enlarged scale, in order that it may be better understood. Fig. 7, is a front elevation of the castle or figuring apparatus; and fig. 8, is an end elevation of the same. T, is the barrel, for giving the tie or figure, which is arranged by varying, at the will of the weaver, the pegs on the periphery of the barrel. K, is a rod or line, attached to a bell-crank or pulley (see fig. 2,), which is occasionally actuated by a peg, set in the barrel, when the shuttle is required to move across the work; but which shuttle does not move without a peg has been so placed, to effect the shuttle's movement,—the object of which

will be explained more fully hereafter. L, is a bar or rod of wood or metal, of a wedge form (in section), and is introduced into the shed by a lever M, which is acted upon by a rotary-cam N, suitably formed for projecting the rod into the open sheds once or twice in the round of the tappet-shaft O, as may be required, and according to the respective sizes of the bevilled pinions P, connected with the driving-shaft.

For the better explanation of that part of the invention which relates to the wedge-formed rod or bar L, intended to be placed between the sheds of the warp, and the form of the shuttle designed to pass along the rod or bar, these parts are shewn on an enlarged scale at fig. 3, which represents, in transverse section, the lay or shuttle-race C, the shuttle Q, the bar L, and the reed R. The shuttle-race or lay and reed is constructed as in ordinary looms. The shuttle is peculiar, having an enlargement in breadth on its inner side; which side is hollowed, as shewn in the figure; and this hollow extends through the entire length of the shuttle. The rod or bar L, is conducted to and fro horizontally in front of the reed by sliding, with its carriage *a*, in a groove *b*, cut in the elongated end of the lay, as shewn at fig. 1, and in the horizontal view of the lay, with the rod and its appendages, as at fig. 4. In order to guide the rod or bar L, and keep it perfectly horizontal in its to and fro movement, a guide-arm S, is attached to its carriage, which slides in a guide-box T, fixed upon the lay above the reed. The construction of the bar-carriage *a*, and its guide-arm S, is best shewn in the enlarged views, figs. 5, and 6, which represent, in elevation and plan, these operating parts detached. The working of the bar or rod L, to and fro, is caused by its attachment to the end of the vibrating-lever M, which is situate between the two rollers of the carriage *a*. The lever M, (see fig. 1,) has its fulcrum in the standard U, and is made to vibrate by an arm V, acted upon by the rotary-cam N. This vibrating-lever M, has a joint in it at *c*, to accommodate the vibrating action of the batten. The rod or bar L, having been placed between the open sheds of the warp, and the shuttle passed, on the batten coming forward, the bevilled edge of the bar will force up the weft-thread into the warp, and form a clear opening for the reception of the next shoot of weft. In order to allow of this action of the bar L, it will be necessary to cause the batten C, to retire an equal distance to the breadth of the bar, which is effected by the following means:—In the end view, fig. 2, it will be seen that the crank-arm W, is connected to the sword D, of the lay by a double-jointed piece *d*; and the pin of the

upper of these joints is set into an upright bar X, the lower end of which is connected to the sword of the lay by a joint-piece or right-angled lever *e*. The reverse end of this lever *e*, carries a small rod *f*, attached to a steel spring *g*,—which spring is affixed to the front of the sword, and keeps the lever *e*, with the upright bar X, and arm W, in the position shewn in the drawing, when the rod or bar L, is between the warps. A hooked lever Y, is pendent in nearly a horizontal position from a joint-pin in the side frame (see fig. 2,), which lever is raised or lowered by a vertical rod *h*, connected with the castle or figuring apparatus above. It will now be seen that, when the figuring apparatus raises this lever Y, (which will be the case when the rod L, is between the warps), the joint-pin *i*, of the right-angled lever will not be acted upon by the hook *k*, of the lever Y, as the batten advances; but, when the lever Y, is allowed to fall (as will be the case when the rod L, is not between the warps), then the advance of the batten will cause the joint or pin *i*, to come in contact with the hook *k*, of the lever Y; by this means the crank-arm W, the upright bar X, and the right-angled lever *e*, will be thrown into the positions shewn by dotted lines, and the batten or lay will thereby be brought forward a distance equal to the width of the wedge-formed rod L. For the purpose of adjusting the distance which the batten or lay shall retire (which must be done according to the breadth of the rod L,), a regulating screw *l*, is inserted in a bracket-piece, fixed to the back of the lay-sword.

The particular novel features of the castle or figuring apparatus (shewn at figs. 7, and 8,) will be understood from the following explanation :—The improved castle consists principally of a sort of organ barrel I, round the periphery of which series of pegs are inserted, for the purpose of working the harness of the loom and weaving figured goods. The peculiar object of this improvement is a self-acting apparatus, capable of shifting the barrel a short distance laterally as the weaving proceeds, so as to produce different ties, forms, or figures in the weaving. Supposing that one series of pegs is set in the barrel to produce a three-leaved twill-tie, and that a second series of pegs, capable of producing a tabby-tie, is set in the barrel beside the former, and a third series in like manner, to produce a four-leaved twill, the action of the barrel will be as follows :—The barrel, shewn at I, is attached to the castle, and mounted in the usual manner of the card-cylinders of Jacquard looms, and is actuated (that is, raised and turned) by a vertical rod *m*, connected at bottom to the ordinary crank-shaft F, in the way well understood. The

rising of the rod *m*, brings the barrel into contact with the steel spring *n*, which stands erect upon the framework of the castle (see fig. 7). The striking in of a peg in the barrel forces back the springs *n*, and causes the hook-bars *p*, *q*, connected to the spring by a horizontal bar *r*, to move sideways; so that the hook of the bar *p*, is withdrawn from the lifting-bar *s*, and the hook of the bar *q*, is brought over the lifting-bar *t*. When in this situation, the rising of the lifting-bars (effected in the ordinary manner) will elevate the right-hand end of the lever z, and thereby cause such portions of the harness to be raised as are connected by the tie required to the right-hand harness-levers *u*; but, in the event of there being no peg in that part of the barrel I, which strikes against the upright spring *n*, the positions of the hook-bars *p*, and *q*, will remain as shewn in the drawing; and the lifting of the bars *s*, and *t*, will then raise the left-hand end of the lever z, and, through the harness-lever *v*, elevate other portions of the harness.

The barrel, shewn longitudinally at fig. 8, is presumed to be pegged to produce a change of three ties; and in this figure only two of the upright springs *n*, are shewn operating, the springs being placed so far apart that the spaces of two pegs may always lie between them. Now, let it be supposed (the whole series of springs *n*, being attached) that the three-twilled tie before mentioned, as pegged upon the barrel, is in operation, acting against the springs, and that it is desired to shift the barrel, so as to produce a tabby-tie. This is effected by means of an endless cord *w*, *w*, passed over two grooved pulleys (see fig. 7,); upon which cord knots, at certain intervals, are provided. This cord is made to travel by a toothed wheel *x*, upon the axle of the lower pulley, taking into a worm upon the crank-shaft. Near the barrel a stud, set into the frame of the castle, carries a couple of levers *y*, and *z*;—the latter of which is much thinner than the former. These levers are shewn detached at fig. 9, and in horizontal view at fig. 10. In the latter of these figures it will be perceived, that near the ends of the shorter arms of the lever there are narrow slotted holes, with open round terminations, made for the passage of the cord *w*. Now, as the cord *w*, travels through the long slot, a knot, coming against the upper side of the thin lever *z*, will cause the shorter arm of that lever to be depressed, as shewn by the dotted lines at fig. 9, and the longer arm to be raised from the step of the barrel marked I. This rising of the lever *z*, enables the barrel, with its axle, to slide a distance equal to the thickness of

the lever,—the barrel being drawn laterally by a weighted cord, as shewn at fig. 8. The descent of the shorter arm of the lever causes the knot of the cord to slide towards the end of the slot, when the knot slips through the circular hole; by which means the longer arm of the lever is allowed to fall again on to the barrel; but, from the sliding of the barrel, the end of the lever is now made to fall upon the step 2, of the barrel. The progress of the cord *w*, now brings the knot into contact with the shorter end of the lever *y*, and, in a similar way to the above, lifts the longer arm of the lever *y*, off the step 1. The barrel, by the weighted cord attached to its axle, is now slidden a little further, but is arrested by the lever *z*, on the step 2; in which situation the pegs of the second or tabby-tie are brought to act upon the springs *n*; and, consequently, the harness is worked so as to produce the variety of weaving required. The same operations go on again, effected by other knots upon the cord *w*, to produce a further lateral movement of the barrel, which brings the pegs of the third tie into operation. When the required amount of the third tie has been woven, the weaver draws back the barrel to its former situation by the cord attached to the right-hand end of the barrel-shaft. If a longer pattern is required to be woven than the periphery of the barrel can receive, an endless band of pegs is employed, as represented at fig. 11; which, being placed upon a barrel, as shewn, is made to travel round as the cards of a Jacquard machine. In order to move the picking-sticks, which throw the shuttle, a peg is placed in the barrel, for the purpose of acting upon one of the upright springs *n*, connected to the lifting motion.

The second head of the invention, which applies to the manufacture of tubes for engine hose, consists principally in the employment of a rod or bar, or a series of rods or bars, as marked L, in the foregoing description;—the object being to effect by repeated blows, in the absence of the shuttles, a very hard beating-up of the work, and to open a clear shed, as explained under the first head. The manner of adapting these rods or bars L, when a series of them are employed, is to attach the short lengths of rod, of wedge-forms, in a horizontal coincident range, by means of arms descending from a guide-rod, which extends across the loom beneath the upper part of the batten. These tubes are to be woven, as respects the tie, in cylindrical forms, in the way well understood; by which means a closer woven fabric is said to be produced than could be obtained without the improved apparatus. These tubular fabrics may be formed of threads or yarns

coated with gutta-percha in the manner about to be described, or of threads or yarns of gutta-percha introduced, side by side, with strands of other materials; and, when woven together, they may, by heat, be made impervious to water.

The method employed for covering the threads or yarns with gutta-percha is as follows:—Fig. 12, is an elevation, and fig. 13, a ground plan of the apparatus employed. A, is a standard, supporting bobbins, whereon the yarns are wound; and B, is a trough, containing gutta-percha in a heated state,—having a double bottom and sides to receive steam or other suitable heating material. Through the gutta-percha in this trough the threads or yarns are conducted, under and over guide-rollers; and, after passing out of the trough, they severally proceed through openings, intended to act as scrapers, to remove any superfluous quantity of the material from each yarn. When this has been done, the yarns are drawn through cold water, for the purpose of cooling; after which they may be wound on bobbins for use.

The third part of the invention consists chiefly in the adaptation of the before-described figuring barrel and its attendant machinery for weaving sacks or bags. The loom is fitted up with an ordinary double shuttle-box, in the usual manner. Upon the top of the loom is to be placed the castle, as described: that is, the arrangement to effect the necessary ties for producing the sack at one operation in the loom, by the employment of the shifting barrel, with three steps or gradations, and three series of pegs. Supposing the lips of the sack to be the first part to be woven, then the two shuttles act alternately; and when a sufficient length is produced to form the lips of the sack, the knotted cord acts upon the levers as described, and, by the sliding of the barrel, brings the next tie into operation, which is suited to weave the body of the sack;—the shuttle-box having fallen, one shuttle only is, in this case, in action. A sufficient quantity for the body of the sack having been thus woven on to the lips, the weaver stops the loom and introduces a much stronger yarn into the shuttle for weaving the bottom of the sack. When a sufficient quantity to form the bottom of the sack has been woven on to the body, other knots on the endless cord come into operation, and raise the levers as before;—thereby shifting the barrel for the purpose of bringing on a tie that will sew up the bottom. It is unnecessary to be more explicit respecting the ties, as the manner of arranging them is well known to practical weavers.

The fourth part of the invention, which applies to the ma-

nufacture of belts or bands for driving machinery, consists in passing strands of hemp, flax, cotton, or other suitable textile material through heated gutta-percha in a trough, as described with reference to figs. 12, and 13. After being cooled and wound on bobbins, they are woven, either with or without strands of gutta-percha, into bands or sheets; after which, they are heated in a hot room to about 200° Fahr.; and they are then subjected to pressure between rollers, in order to bring the substance into one mass: if woven in sheets, they may be then cut into widths of any required breadth, suitable for driving machinery. By these means a material is produced which, when employed for machine-belts, is much cheaper and less likely to stretch than bands made of gutta-percha alone.

The fifth head of the invention applies to the manufacture of ropes. The patentee takes strands of hemp or other material, and treats them as described with reference to the second head of the improvements, which relate to the use of the apparatus shewn at figs. 12, and 13; and from the tank or bath of heated gutta-percha any number of the coated strands required for the thickness of the rope are passed (in their heated state) in a compound form, and without further twisting, through a series of conical tubes C, C, C, figs. 12, and 13. The end of the rope is then made fast to the axle or barrel of a crab D, or other winding machine, and the rope is drawn by power through the several tubes, which have progressively decreasing diameters from the first, so as to press the rope into a more compact state as it proceeds; and the superfluous liquid gutta-percha, as the rope passes through the tubes, falls down into receptacles below. The patentee states, that he has found it desirable to apply heat to the tubes during the operation; and for that purpose jets of gas are adapted, as shewn in the drawing.

In the manufacture of twisted ropes, the patentee employs the yarns coated with gutta-percha, and, after cooling them, he twists the several strands together in the ordinary way of making ropes; he next heats the twisted rope to a temperature of about 200° in a hot room, and draws the rope through a conical tube, for the purpose of compressing the materials and bringing them into a more compact body.

He claims, First,—in reference to looms, the employment of the wedge-formed rod of wood or metal, and the mode of passing it between the warps by mechanical means, so as to drive up the weft and form a clear shed by the action of the batten, in the way described; and also the mode of shorten-

ing the rope of the batten, in order to allow the wedge-formed rod to be beaten up only to that distance where the weft is desired to go. Secondly,—the method of introducing, in a similar manner (by power), rods or bars of wedge-forms, to weave one or more tubes simultaneously; which tubes may be made in combination or not with the gutta-percha, in the way before described. Thirdly,—the manufacture of sacks, in the peculiar way described, by which the bottom of the sack is made stronger than the other parts, and the lips are woven by the introduction of two shuttles;—the sacks being made perfect in the loom by these means, and only requiring to be separated. Fourthly,—the improved manufacture of driving-bands, in the way described. And, Fifthly,—the improved mode of manufacturing ropes, as explained above.—[*Inrolled December*, 1849.]

To BARTHOLOMEW BENIOWSKI, *of Bow-street, Covent-garden, in the county of Middlesex, Major in the late Polish army, for improvements in the apparatus for, and process of, printing.*—[Sealed 26th April, 1849.]

This invention relates, firstly, to improvements in connection with types for letter-press printing; secondly, to improvements in apparatus for composing type; thirdly, to improvements in apparatus for inking printing surfaces, or supplying them with coloring matter; and, fourthly, to improved machinery for printing.

The improvements under the first head of the invention (relating, as above stated, to types) consist, in the first place, in rendering the ordinary shape of the body-part of types more suitable for printing from cylindrical surfaces. It will be easily understood that, in composing with the ordinary types on a cylindrical surface, a truly cylindrical surface of type cannot be obtained without employing types of a slightly tapering form, which must of course vary, however slightly, with every changing diameter of cylinder upon which they are imposed; and, for this reason, it would be necessary to have a special shape of type for each machine. The patentee obviates this by coating the ordinary types with different thicknesses of varnish at different parts of the length of their back and nick surfaces, and thereby produces the taper required. The method he prefers of effecting this is as follows:—The types are placed upon a flat surface, such as a type-founder's setting-up stick, with the back-side upwards, and a

coat of varnish is laid over about half of the type surface thus presented, from the foot upwards; then a second, and, if necessary, a third coat is laid over about a quarter of the surface;—when dry, the type is turned over by the ordinary means practised by type-founders when "dressing" type; and a similar coating is given to the nick side; and, after the varnish is hardened, the types are dressed in the ordinary manner, to remove any asperities which may be on the edges thereof. Types will thus be produced tapering from the foot upwards.

The types, prepared as above, are intended to be used for printing from the improved machine, for which the present inventor obtained letters patent in October, 1847, in which the types are set up on the inside or concave surface of a cylinder; but it will be understood that, when required to be used in machines having a convex printing surface, the upper portion of the type, or that nearest the face, must be made the thickest.

As types, prepared in the above manner, could not be cleaned in the ordinary way with a solution of potash without destroying the varnish, the patentee employs a method somewhat similar to that usually adopted for cleaning wood engravings. The substance he uses for this purpose is common turpentine; and to prevent this from entering the interstices between the types, and thereby acting upon the varnish, he proceeds as follows:—The inking-rollers are first thrown out of gear, or taken out, and the types cleaned as much as possible by passing a few sheets through the machine; water is then poured over the types, and their printing faces are dried with a sponge, leaving the water in the interstices; then, with a brush dipped in turpentine, the faces of the types are cleaned,—while the turpentine is prevented by the water from acting upon any other part of the type; a few more sheets of paper are then again passed through the machine, and the types will be as clean as when first cast.

The next improvement under this head consists in the construction of moulds for casting types. In Plate VIII., fig. 1, represents one of the improved moulds complete; and figs. 2, and 3, shew the two halves of the same, separated. The peculiarity of this mould consists in its being so constructed as to receive the type-metal at the side instead of at the top, as usual. The orifice or channel for the reception of the melted metal is shewn at *a*. By such construction of the mould, great economy is said to be effected, as the most expensive parts of the mould, viz., the mouth-pieces, and a great portion

of the back plates, are dispensed with. It will be understood that the process of casting is performed by means of the pump. Another advantage in casting from the side instead of the top is, that the "blowing" occurring at the "break," when casting with the pump, being at the side instead of the foot of the types, is less injurious: this advantage will be readily understood.

The second head of the invention, which relates, as above stated, to improvements in apparatus for composing types, consists, firstly, in an improvement in the apparatus designated as the Authoriton, and described in the specification of the inventor's former patents, severally bearing date the 17th November, 1846, and 14th October, 1847*; and, secondly, in an apparatus denominated the "revolving composing-stick."

The improvement in the Authoriton consists in cutting notches in the partitions which separate the types;—the object being to allow the tweezers to pick up any type that may lie close to the partition, by admitting the leg of the tweezers through the notches.

The revolving composing-stick is shewn in elevation at fig. 4. It consists of an angular piece *a,* which may be of any suitable material, attached to which is a composing-stick *b,* of the ordinary construction. The piece *a,* is mounted on the top of a vertical rod *c,* which passes through a hole in the table *d;* and the lower end of this rod turns in a socket supported by a bracket *e,* screwed to the table *d.* The advantages of this apparatus are, first, that the compositor is enabled to handle the composing-stick with much greater facility, as he can turn it to any required position; and, secondly, he is relieved from the weight of the composing-stick and types contained therein. This apparatus can only be conveniently used when composing from the Authoriton.

The third head of the invention consists in covering the composition usually employed for the manufacture of inking-rollers with some material which shall have the effect of protecting it from atmospheric influences, and also allow of the inking-cylinders being driven at an increased speed, without the risk of the composition being melted or otherwise injured by the heat caused by the rapid motion. Various substances, such as gutta-percha or ordinary India-rubber, may be employed for this purpose; but the patentee prefers the substance known as vulcanized India-rubber. These rollers are constructed by pouring the melted composition into vulcanized India-rubber tubes, in the centre of which a rod is

* For description of the inventions see Vol. XXXI., page 166, and Vol. XXXIV., p. 320.

placed to serve as the axle. A very effective roller may also be made by pouring water or any other liquid into a vulcanized India-rubber tube, one end of which has been stopped with a perforated stopper, having a rod passed through its centre; which rod extends through the tube, and projects to any convenient distance beyond it. When the tube is filled with water, the other end is stopped up by passing a perforated stopper over the other end of the rod, and inserting it in the tube: it will, of course, be understood that both ends of the roller, thus formed, must be rendered water-tight.

The improvements in machinery for printing, which constitute the fourth head of the invention, relate principally to the operations of feeding, conducting, and delivering the paper during the operation of printing. Fig. 5, is a front elevation of the concave cylindrical printing-machine, described in the specification of the patent of 1847, with the present improvements adapted thereto; and fig. 6, is a plan view of a portion of the cylinder and framework. A, A, is the framework of the machine; and B, B, is the main cylinder, in the interior of which the forms of type are imposed. This cylinder is mounted on antifriction rollers C, and driven as described in the specification of the above-mentioned patent. D, D, are the printing-rollers, mounted in brackets attached to the framework; E, E, are the distributing-rollers; F, is one of the inking-rollers; G, is the ink-fountain; and H, is the vibrating roller for supplying the inking-table with ink. The inking apparatus is also driven as described in the former patent. The position of the form of type is represented at I. *a, a,* are the feeding-boards, upon which the paper to be fed into the machine is placed; and *b, b,* are the delivery-boards, which receive the paper after it has been printed upon: these boards move in slides, in order to allow of their being taken out separately when required. *c, c,* are rollers, mounted in a vibrating frame K, and extending across the machine. Around these rollers an endless blanket *d,* is passed, which is furnished with strips of a sticky substance for picking up the paper and feeding it into the machine. These strips are shewn at *s, s,* in the enlarged views, figs. 7, and 8. *e, e,* are pinions, mounted on the ends of the rollers *c*; and into these pinions fixed vertical racks *f, f,* gear, as shewn in the drawing. At each end of the frame K, in which the feeding-rollers *c,* are mounted, is fixed a lever *g,* which oscillates vertically on a fulcrum *h,* projecting from the framing A, A.—*i,* is a strong spring, fixed to the framework, which raises the lever *g,* by pressing upon its short arm. This spring is furnished with a roller *i*,* which is acted upon by a cam *j,* (shewn

by dots in fig. 5,) fixed to the interior of the main cylinder. To the longitudinal stationary piece *k*, are fixed hooked guide-springs *l*, which partly surround the printing-cylinder D. *m*, are delivering-bands, passing round rollers *n*, supported by brackets attached to the feeding-board *a*, immediately above. The delivering-bands *m*, are severally furnished with looped pieces of India-rubber, leather, or other elastic substance *m**, denominated "skating-pieces." These skating-pieces are intended, as the paper is delivered from the printing-roller, to press it upon and slide it up a rail *o*, *o*, which is termed a "skating-rail." To the chase, containing the form of type, are affixed "margin-pieces" *p*, as shewn at figs. 7, and 9. These pieces project above the printing surface of the types about one-sixteenth of an inch, and are made of India-rubber, leather, or some other elastic substance.

The operation of this machine is as follows:—Paper having been placed upon the feeding-board *a*, (as at *z*,) motion is communicated to the main cylinder B, as described in the former specification, when the cam *j*, (shewn by dots at fig. 5,) will raise the spring *i*, from the lever *g*, (as shewn also by dots at fig. 5,), and the vibrating-frame K, with the feeding-rollers *c*, will be allowed to fall upon the paper *z*, on the feeding-board *a*, by which the top sheet of paper will be caused to adhere to the sticky strips *s*. The cam *j*, having passed the spring *i*, allows that spring to fall and press upon the lever *g*, by which the said lever is made to raise the frame K, and rollers *c*, *c*; which rollers, in rising, are caused to revolve by means of the toothed pinion working in the fixed rack *f*; and the sticky strips, which are attached to the endless blanket *d*, surrounding the rollers, will lift up a sheet of paper from the board *a*, (as shewn at fig. 7); and the rollers *c*, *c*, revolving within the blanket *d*, and strips *s*, (by the rack and pinion, as before mentioned) will cause that sheet to be moved forward, until its advancing margin comes in contact with the hooked springs *l*, *l*. Simultaneously with this just-described progress of the sheet, it is progressively detached from the sticky strips *s*, by means of wires *q*, which stretch across the oscillating frame K, in the spaces between the sticky strips: the ends of these wires are fixed to the frame K. The paper is now in a position to be carried forward by the margin-pieces *p*, and printing-cylinder D, and next between the printing surface and printing-cylinder D. Simultaneously with this last progressive motion of the paper, the sheet slides upon the hooked wires *l*, and also becomes detached from the printing surface, and is progressively guided round the printing-

cylinder D, until it is caught between the skating-pieces $m*$, (attached to the band m,) and the polished skating-rail o, o, (as shewn at fig. 7). These skating-pieces continue to cause the advancing corners of the paper to slide forward until they leave the rail and allow the sheet to fall down. By this time the feeding-rollers will have fed another sheet beneath the printing-roller D, ready to be operated upon by the margin-pieces p, hooked wires l, and second skating-pieces $m**$.

The manner in which this mechanism is arranged for feeding, printing, and delivering the paper at the left-hand side of the machine is shewn on the left-hand side of fig. 5.

From the above description it will be understood that the operations of feeding and receiving are performed without the aid of feeding and receiving boys. It will also be evident that, instead of effecting the oscillating motion of the feeding apparatus by the cam-piece j, and spring i, it may be done by a boy;—in such case, two or more feeding apparatuses should be connected by a vertical bar, jointed to two or more feeding-frames, in a manner more or less similar to that shewn at fig. 10; so that one and the same boy, moving the bar up and down periodically, may perform the operations necessary for the feeding of two or more printing-cylinders.

For the sticky substance, employed by the patentee, as above mentioned, various substances might be used with more or less advantage, such as simple wax, cobbler's wax, various plasters, in particular the diachylon of the Pharmacopœia Londinensis, &c., provided they possess the property of sticking easily to paper, and of being detached therefrom without soiling it. The substance, however, which is preferred, is prepared as follows:—Take India-rubber and immerse it in olive oil, or other fixed oil, for a few days, until it becomes of a clammy nature, then dry off the superfluous oil by means of a cotton or linen cloth, and the substance is ready for use. Should this substance lose its sticky properties, they will be restored by rubbing into it a small quantity of oil. The advantages said to attend the employment of the sticky substances for the feeding operation are as follows:—First, it enables the paper to be raised and carried forward in confined and narrow spaces; secondly, sheets of larger dimensions than usual may be raised and fed with ease and precision; and, thirdly, it allows of the operation of feeding being performed automatically, which has not hitherto been even attempted.

The patentee claims, First,—the method above described of manufacturing tapering types. Secondly,—the novel con-

struction of mould for casting types, above shewn and described, in which the channel for the fused metal is formed in the body and "carriage" of the mould,—the ordinary mouth-pieces being dispensed with. Thirdly,—forming the notches in the partitions of the Authoriton to admit the leg of the tweezers. Fourthly,—the peculiar construction of apparatus called the revolving composing-stick. Fifthly,—protecting the ordinary composition of which inking-rollers are made, from atmospheric influences and injury caused by rapid motion, by covering it with any suitable material, such as vulcanized India-rubber. He also claims the manufacture of inking-rollers, by filling tubes, of any suitable material, with water or other fluid. Sixthly,—the employment of a sticky substance for lifting up and moving the paper forward. Seventhly,—the mode employed for detaching the paper from the sticky substance. Eighthly,—the peculiar mechanism by which the sheets are carried forward. Ninthly,—the peculiar mode of guiding (in the act of printing) the sheet by sliding contact instead of rolling contact, by which the expensive and troublesome mode of employing endless bands and all their necessary appendages are dispensed with. Tenthly,—the mode described of carrying forward the printed sheet and depositing it on the delivery-board. Eleventhly,—the mode above described of carrying the paper by means of the margin-pieces; which motion is entirely different from the usual mode of effecting the same by dropping-bars, grippers, &c. And, Twelfthly,—the adaptation to printing machinery in general of the above-described methods of feeding the paper, carrying it between the printing-cylinder and printing surface, and delivering it from the machine.—[*Inrolled October*, 1849.]

To JAMES ROBINSON, *of Huddersfield, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear.*—[Sealed 30th August, 1849.]

IN the manufacture of orchil and cudbear, it is the practice to make the ground lichens into a paste with liquid ammonia, and then to submit that paste to the action of the atmosphere; but, in consequence of the mixture being in a thick mass, a considerable length of time is occupied in turning it over and over, in order that the whole of it may be subjected to the action of the atmosphere; and the manufacture of it is therefore attended with considerable difficulty and expense.

The first part of this invention consists in causing the paste,

prepared in the ordinary manner, to be forced through small openings or orifices, of any required form, into vessels or receivers; whereby the air will be enabled to act upon the paste with greater effect; and the time occupied in the manufacture will therefore be considerably shortened. The patentee does not confine himself to any particular arrangement of machinery for effecting this object; but he prefers to employ a cylinder, having its bottom perforated with numerous holes, about one-eighth of an inch in diameter, and provided with a piston or plunger, by which the paste is driven through the holes. For obtaining paste-orchil, the paste is to be subdivided in this manner twice a day; and this process should be continued for three days.

The second part of the invention consists in a mode of drying paste-orchil for the purpose of converting it into cudbear. The patentee takes orchil-paste which has been subdivided in the manner above described, or orchil-paste prepared in the ordinary way, and passes it through a machine of a similar character to that above mentioned,—permitting it to fall lightly on to a suitable surface, for the purpose of drying: when dry, it will be fit to be ground, as usual.

The patentee does not claim the mixing lichens with liquid ammonia; nor does he confine himself to the precise details above given; but what he claims as his improvements in preparing or manufacturing orchil and cudbear is, Firstly,—the causing the paste to be passed through orifices or openings, whereby the surfaces thereof are more largely exposed to atmospheric air. And, Secondly,—the mode of drying paste-orchil, when converting it into cudbear.—[*Inrolled February,* 1850.]

To WILLIAM GOOSE, *of Birmingham, in the county of Warwick, manufacturer, for certain improved machinery for manufacturing nails,—being a communication.*—[Sealed 5th June, 1849.]

This invention relates to the manufacture of what are termed cut-nails, which are nails produced by cutting them from a strip or plate of iron or other metal or alloy, and then compressing or "griping" them between dies. In the ordinary mode of manufacture, the unfinished nail, after being separated from the strip or plate by the cutters, is subjected to the action of the dies, which compress or gripe it in the direction indicated by the arrows in Plate IX., at fig. 1,—such figure exhibiting a transverse section of the nail. This pres-

sure of the dies upon the edge of the nail has a tendency to separate the fibres of the metal; the patentee therefore proposes to partially turn the nail after it is separated from the strip or plate by the cutters, in order that the compressing or griping dies may act upon the sides instead of the edges of the nail (as indicated by the arrows in the section fig. 2,), which will have the effect of consolidating the metal; and the invention consists in the application of apparatus, suitable for turning the nail, to the ordinary machinery employed for making cut-nails.

Fig. 3, is a side view, and fig. 4, is a front view of the apparatus used for carrying out the invention. *a*, is a vertical shaft, carrying a bar *b*, termed a "spring-nipper;" the outer end of which bar is capable of moving or springing upwards or downwards in a vertical plane; but it is prevented from moving laterally by the hooked or overhanging end of the arm *c*, which is affixed to the shaft *a*. The shaft *a*, is caused alternately to perform part of a revolution in one direction, and then part of a revolution in the opposite direction, by being connected with the main shaft or other suitable moving part of the nail-making machine. As soon as the nail is separated from the strip or plate of metal by the cutters, it is caught between one of the compressing-dies and the edge of the spring-nipper, as shewn in the diagram, fig. 5,—where *d*, represents the compressing-die, *e*, the spring-nipper, and *f*, the nail, which is held in a horizontal position between them. The shaft *a*, now beginning to revolve, causes the spring-nipper to approach the compressing-die; but, as the spring-nipper is prevented by the nail from approaching the die in a horizontal line, it springs downwards, carrying the nail into the position shewn at f^1, in the diagram fig. 6, and finally into the position shewn at f^2, in the diagram fig. 7. The other compressing-die (*g*, fig. 7,) now advances for the purpose of completing the nail; and the shaft *a*, being caused to revolve in the reverse direction, carries back the spring-nipper into its first position, ready to receive a fresh nail.

The patentee says he is aware that cut-nails have or may have been compressed or griped on their flat sides; he does not, therefore, claim the compressing or griping of cut-nails on their flat sides; but he claims the method, above described and represented in the accompanying drawings, of constructing and working a springing nipper, for the purpose of turning the said cut-nails preparatory to the action of the compressing or griping-dies.—[*Inrolled December*, 1849.]

To Andrew Peddie How, *of the United States, but now residing in Basinghall-street, in the City of London, engineer, for an instrument or instruments for ascertaining the saltness of water in boilers.*—[Sealed 18th July, 1849.]

The subject of this invention is an instrument called by the patentee a salinometer, by means of which the engineer is enabled to ascertain, at all times and under all circumstances, the density and consequently the saltness of the water in the boilers of marine steam-engines, independently of the pressure within the boiler.

In Plate VII., fig. 1, is a vertical section of the salinometer; and fig. 2, is another vertical section, taken at right angles to fig. 1. *a,* is a small cylinder, having at its lower end a projecting piece, which is bolted to the side *b,* of the boiler; through this projecting piece two passages *c, d,* are formed, leading into the pipes c^1, d^1, which terminate respectively at the upper and lower parts of the boiler; and the passages *c, d,* are provided with cocks c^2, d^2.—*e,* is an overflow or waste-pipe, for carrying off all excess of water from the cylinder *a*;—*f,* is a cock for discharging all the water from the cylinder *a,* when desired; *g,* is an hydrometer, the graduated stem of which works through a hole in a fixed guide *h*; and *i,* is a thermometer.

The action of the instrument is as follows:—Either the cock c^2, or the cock d^2, is left open (according as it may be desired to test the density of the water at the upper or lower part of the boiler), and the water passes from the boiler through the passage *c,* or *d,* into the cylinder *a,* and is discharged therefrom through the overflow or waste-pipe *e*; so that there is a constant flow of water through the salinometer of the same density as the water in that part of the boiler from which the supply is derived; and this density is ascertained by examining the graduations on the stem of the hydrometer. If the water, which is passing through the instrument, is derived from the upper part of the boiler, and it is desired to test the density of the water in the lower part thereof, the cock c^2, is to be closed and the cock d^2, opened; then the water from the lower part of the boiler will quickly drive out of the cylinder *a,* (through the overflow or discharge-pipe) all the water that had previously entered from the upper part of the boiler; and the water which flows through the cylinder *a,* will then be of the same density as the water in the lower part of the boiler.

A thermometer is combined with the instrument, because the density or saltness of the water varies with the degree of temperature, and it is necessary to correct the indications of the hydrometer by those of the thermometer, as often as the temperature rises or falls beyond the standard point to which the hydrometer may have been graduated. Thus, supposing the hydrometer to have been graduated on the assumption of the water being at a uniform temperature of 200° Fahr., and that $\frac{2^\circ}{32}$ represents the density of the water at that temperature, the patentee finds that for every increase of 10° in the temperature of the water, one-eighth of a degree, or thereabouts, must be deducted from the amount of density indicated by the hydrometer; and for every decrease of 10°, one-eighth of a degree, or thereabouts, must be added. For example, if the temperature is increased to 210°, a deduction of one-eighth must be made, on that account, from the $\frac{2^\circ}{32}$, which will bring the density to $\frac{1\frac{7}{8}}{32}$; or if the temperature is lowered to 180°, an addition of two-eighths must be made, which will make the corrected density $\frac{2\frac{1}{4}}{32}$.

The patentee does not strictly confine himself to the above details, so long as the peculiar character of his invention be retained. He makes no claim to the application of either the hydrometer or the thermometer to ascertaining the density or saltness of the water of marine steam-engine boilers; but that which he claims is, the peculiar arrangement, combination, and adaptation of means (each by itself well known) embodied in the single instrument above described, whereby the marine steam engineer is enabled, by the mere inspection of the said instrument, to ascertain, at all times and under all circumstances, the density of the water in the boiler, independently of the pressure within the boiler.—[*Inrolled January,* 1850.]

To Richard Archibald Brooman, *of* 166, *Fleet-street, London, patent agent, for certain improvements in draught-horse saddlery, harness, and saddle-trees,—being a communication.*—[Sealed 13th September, 1849.]

This invention consists, firstly, in the employment of wrought or cast-iron and steel for manufacturing those parts of draught-horse saddlery and harness which have heretofore been composed of a combination of wood, leather, and iron; and, secondly, in constructing cart and other saddles, and stanhope

and other pads, with steel plates or hinge-joints, so as to render them self-adjusting.

In Plate IX., fig. 1, shews a gig-saddle, manufactured according to this invention. The part *a*, is made of iron, and may be ornamented with any suitable device, in imitation of stitches or otherwise, and afterwards japanned, lacquered, or bronzed: in some cases, the patentee prefers to make the part *a*, of cast-iron, and afterwards to anneal it. Each of the flaps *b*, is attached to the part *a*, by means of a steel plate or spring *c*, in order that the flaps may adjust themselves to the body of the horse; and the saddle, thus formed, is lined and padded in the ordinary way.

Fig. 2, represents a carriage-pad, which may be made of cast-iron, and afterwards annealed; or it may be stamped out of sheet-iron. After being painted, lacquered, or japanned, and fitted with terrets, &c., it is lined with leather and padded. When the pad is made of cast-iron, the patentee prefers that there should be small pins *d*, formed on the under side of it: these pins are annealed, and then serve as rivets for attaching the leather lining to the pad.

The patentee next shews a stanhope-pad, which closely resembles the carriage-pad, fig. 2,—the principal difference being that the stanhope-pad is composed of two thicknesses or plates of metal, the inner one of which is bent, so as to form a passage or channel for the reception of the back-band, as exhibited at *h*, fig. 3.

Fig. 4, represents part of a carriage-pad, constructed with a hinge-joint, so as to render it self-adjusting; and figs. 5, are enlarged views of the parts composing the hinge-joint. The pad consists of a part *a*, and two flaps *b*,—all of metal. The hinge-joint is formed of a short cylindrical piece *e*, from the centre of which a square projection *f*, rises, and on the top of this there is a smaller square projection;—the cylindrical piece *e*, is placed beneath the flap *b*, which is bent in a semi-circular form over it; the projection *f*, extends through a rectangular opening in the flap *b*, and upon it the end of the part *a*, is placed (the smaller projection entering a corresponding recess in the part *a*,); and then all the parts are secured together by screwing the stem of the terret *g*, into the projection *f*, and piece *e*, as indicated by the dotted lines. Instead of a hinge-joint, the flaps *b*, may be attached to the part *a*, by steel plates or springs, as in the gig-saddle shewn at fig. 1.

Fig. 6, exhibits a cart-saddle. The saddle-tree bow *i*, is made of iron, and is furnished with four small pins or pivots,

which fit into suitable recesses in the bearings or brackets *j*, affixed to the back-boards or pads *k*; and the back-boards, being thus pivotted to the bow, can readily adjust themselves to the back of the horse.

Fig. 7, represents a "winker" for bridles, which may be stamped out of sheet-iron; or it may be formed of cast-iron, with the socket or hollow piece to receive the cheek-strap.

The patentee claims, Firstly,—the employment of wrought or cast-iron to and for the purposes hereinbefore specified. Secondly,—the mode of constructing cart and other saddles, stanhope and other pads, with steel plates or hinge-joints, so as to render them self-adjusting, as hereinbefore described.—[*Inrolled March,* 1850.]

To Alfred Vincent Newton, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in derricks for raising heavy bodies,—being a communication.*—[Sealed 9th August, 1849.]

This invention of improvements in derricks for raising and moving heavy bodies is shewn in Plate IX., wherein fig. 1, is a perspective view of the apparatus, and figs. 2, 3, and 4, are detached views of parts of the same.

Instead of making the boom, destined to sustain the weight to be lifted, as heretofore to project all on one side of a mast, it is secured at about the middle of its length to a short central mast, which turns in appropriate bearings in the upper part of a rigid frame or standard. The rear end of the boom is connected by a travelling brace-rod with the base of the standard, which is made circular, and has on its under side a circular rail, upon which a pair of friction-wheels (having their bearings in the lower end of the brace-rod) run, and thus admit of the free turning of the boom. The rope by which the weight to be lifted is raised is pendent from a pulley, which has its bearings in a sliding block; this block is supported by and traverses over a pair of rails, together forming one end of the boom; and it is capable of being moved from or towards the central mast by means of two cords attached to it for that purpose. One of these cords is carried over a pulley, mounted in a recess in the mast, and is passed down through the mast, which is made hollow for that purpose; the other cord passes from the block over a pulley at the extreme end of the boom, then backward over another

pulley in the mast, and its end is passed down through the hollow mast. The lifting-rope is carried by two pulleys,—the one being mounted in the mast and the other in the sliding block. The loaded end of the cord hangs from the pulley in the sliding block; and the other end, which is carried over the pulley in the mast, is passed down the hollow of the mast to the capstan or windlass employed to lift the load. This arrangement of parts will admit of the load being turned in any direction and deposited at any given point within a circle of which the boom is the radius. The standard in which the mast is mounted is formed like a triangular pyramid, and it may be provided with wheels to allow it to run on a permanent railway, and thereby be moved to any required distance with facility. The upper end of the standard consists of three posts, placed at equal distances apart at their base, and uniting at their upper ends. These posts are connected together by horizontal ties and by diagonal braces, crossing each other, so as to give strength and rigidity to the structure.

At fig. 1, *a, a, a,* are the three inclined posts of the framed standard, properly secured to a base *b,* and connected together, to form a triangular pyramid, by horizontal cross ties *c, c, c,* mortised or otherwise secured, and braced together, by diagonal braces d, d^1,—those indicated by *d,* inclining to the right, and the others d^1, inclining in the reverse direction. These braces are arranged in the same manner on each face of the triangular pyramid, there being two braces on each face, extending from one cross tie to the other; and, it will be observed, that, commencing at the base of either of the posts, the two sets form continuous systems of braces, running diagonally all around the pyramid, from top to bottom, and forming a stiff and unyielding structure, which, therefore, is peculiarly adapted to sustain heavy loads, and resist the strain to which the standard of a boom-derrick is subjected, but to which a single mast, sustained by guy ropes, is ill adapted. The braces *d,* and d^1, overlap each other in the middle and at the ends; so that by one single bolt *e,* (see the diagram fig. 5,) the ends of four braces are connected together and with the posts: when desired, intermediate cross ties may be introduced. The base *b,* is formed of timbers, connected together in a triangle, to correspond with the horizontal section of the pyramid; and then, by other timbers, a circular form may be given to it, to receive, on its under side, a circular rail *f,* (see the cross section of the circular base, fig. 2,) over which runs a pair of friction-rollers *g, g,* having their bearings

in the lower end of the brace-rod *h*,—which rod forms a tie between the back end *i*, of the boom and the base of the standard. The sustaining or forward end of the boom is composed of two straight timbers *k*, *k*, placed at a sufficient distance apart to admit of a free passage between them of the rope *m*, (by which the weight to be raised is lifted) and of the pulley *n*, over which the rope passes. These timbers form rails, on which the block of the pulley *n*, can slide or run, if mounted on wheels. They are firmly connected together at their outer extremities; and their inner ends embrace and are firmly secured to the mast *o*, and to a single timber *l*, which forms the rear or balance-end *i*, of the boom, to which the brace-rod *h*, is attached. The mast *o*, is mounted in the upper end of the standard frame, and turns freely in bearings provided for its reception; and the lower end of the mast is made hollow, for the passage downwards of the ropes, to admit of the boom being turned without obstruction;—there being pulleys, as before mentioned, to guide the ropes into the hollow in the mast. The upper end of the mast is provided with a metal plate *q*, to which is attached a system of brace-rods r, r^1, for securing the boom to the mast. The rods *r*, which sustain the end e^1, of the boom, are branched and attached to the two rails or timbers *k*, *k*, to admit of the free passage of the sliding block, which is governed and moved towards or from the mast by means of two ropes *s*, and *u*;—the rope *s*, being attached to the block, and passing through the mast over a pulley *t*, to draw it towards the mast; and the other rope *u*, being attached to the sliding block, and passing over a pulley or pulleys *v*, at the end of the boom, and thence over another pulley, which has its bearings in the mast by the side of the pulley *t*. The hoisting rope *m*, after passing over the pulley *n*, passes over a pulley on the same bearing-pin as the pulley *t*, and thence downwards through the hollow mast to a windlass or other apparatus: the boom is braced laterally in any suitable manner.

If it be desired to move the whole apparatus to facilitate the work, the base *b*, may be adapted to run on permanent rails *y*, *y*, in any desired or well-known manner, by being careful to have the base principally sustained by means of timbers *z*, one of them under one of the posts of the standard, and the other under the other two posts, as the weight will then rest to the best advantage; and care should be taken to have the base sufficiently elevated to give a free passage to the rollers *g*, on the end of the brace-rod *h*. In order to ensure a more permanent connection between the boom

and the standard, the under surface of the circular platform is provided with a second or additional iron rail a^1, as shewn in the section, fig. 2, and in the plan view, fig. 3. Upon the rail *f*, the rollers *g*, of the brace-rod *h*, run, as before mentioned; the inner ends of the axles of these rollers are bent up at a right angle to receive respectively a horizontal roller g^1; which rollers are intended to run upon the rail a^1; and by this means the strain put upon the boom by the load is (through the connecting-brace *h*,) communicated to the base *b*, of the standard in both a vertical and horizontal direction. The outer ends of the axles of the rollers *g*, *g*, are connected together by a brace-piece (see fig. 4,); and this brace also forms a bearing for the axle of a pinion, the teeth of which take into the teeth on a portion of the periphery of the rollers *g*, *g*. On the axle of this pinion is a winch-handle, by turning which the boom will be caused to swing round into any desired position. For greater safety against any sudden jerk, the inventor proposes to have a rail on the upper surface of the base *b*, and to provide the brace *h*, with another roller *g*, to bite upon that rail.

The patentee claims the general arrangement and construction of parts constituting the improved derrick, as above described, with reference to the accompanying drawing.—[*Inrolled February*, 1850.]

To Frederick Chamier, *of Warwick-street, in the county of Middlesex, Commander in the Royal Navy, for improvements in the manufacture of ships' blocks,—being a communication.*—[Sealed 23rd August, 1849.]

This invention consists, firstly, in strapping wooden blocks with metallic wire, preserved from oxidation by any suitable means; secondly, in the employment of a metal strap, so contrived and placed as to hinder the spliting of the block; thirdly, in substituting sheets of metal for wood in the manufacture of blocks; and, fourthly, in manufacturing sheaves of sheets of metal, rivetted together, with a polygonal bush of metal or leather.

In Plate VIII., fig. 1, is an edge view, and fig. 2, a side view, of a block, shewing the method of strapping blocks with wire, which should be protected from oxidation by tinning, galvanizing, or painting, or by the nature of the wire itself. The strapping is effected by a multiplicity of folds of a continuous wire; and a single transverse ligature *a*, between the

block and the ring, is sufficient for security. By this system splicing is avoided, and the art of strapping a block is much simplified.

Fig. 3, is a side view of a block of the kind now in use, with the metallic strap differently arranged, for the purpose of supporting directly the weight which bears upon the sheave and its pin or axis, and thus obviating the general tendency of blocks to split. In this figure it will be seen that the lower part of the wire strap is formed into a kind of loop to receive the pin *b*, of the sheave; whereas, in figs. 1, and 2, the wire strap passes completely round the block, and the strain is transmitted from the pin *b*, (represented by dotted lines) through the block to the strap. Fig. 4, is an edge view, and fig. 5, a side view of a double-tailed block, shewing how the counter-strap is arranged, so as to maintain an even strain in all parts of the strap when coupling blocks together.

Fig. 6, is a side view, and fig. 7, an edge view of a single metal block, wire-strapped. The metal block is composed, in the first instance, of a piece of thin metal, folded into the shape shewn at *c*, figs. 8, and 9, so as to form a protection or guide to the rope which is to pass through the block; to the exterior of this piece of metal the wire strap *d*, is applied; then, to obviate the inconvenience which would be experienced if the block were left with sharp edges, a second plate or shell *e*, (figs. 6, and 7,) of thin metal, is placed on each side of the first plate, and soldered or rivetted thereto; and the space between the plates *c*, and *e*, is filled with melted rosin, asphalte, or any other suitable substance that can be brought to a liquid state by heat, and will become hard when cold. The melted rosin is introduced through a hole in the plate *e*, which is afterwards closed by a cover *f*.

In making a metal block to contain two sheaves, the central part of the wire strap is carried downwards between those parts of the plates *c*, (see figs. 10, and 11,) which form the partition c^1, that separates the two sheaves; and the outer parts of the wire strap are carried down the outside of the plates *c*; so that the pin or axis of the sheaves will be supported by the wire strap at the centre as well as at the ends. For a block to contain three sheaves, the central portion of the wire strap is introduced into each of the spaces between those parts of the plates which form the two partitions that enclose the centre sheave; and the outer parts of the strap extend down the outer sides of the plate *c*: the pin will thus be supported by the wire strap near the ends thereof, and at two points equidistant from the former and from each other.

Fig. 12, is a side view, and fig. 13, is a transverse section of a metal sheave constructed according to this invention. It is made by rivetting together suitably-shaped pieces of sheet metal (as will be readily understood on examining figs. 12, and 13,); and it has a polygonal brush g, of metal or leather, which is shewn separately at figs. 14. To prevent the pin or axis of the sheave from turning in the block, the patentee forms the pin with a projection or feather near the head thereof, as represented at b^1, in figs. 15.

The patentee claims, Firstly,—the strapping of wooden blocks by means of metallic wire, preserved from oxidation by any means. Secondly,—a metallic strap, so contrived and placed as to hinder the splitting of the block. Thirdly,—improvements in the making of blocks by substituting metal in sheets, preserved from oxidation, for wood. Fourthly,—the manufacture of sheaves made of any metal in sheets and rivetted, having a polygonal "bouch" in either metal or leather.—[*Inrolled February,* 1850.]

To Richard Kemsley Day, *of Stratford, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics.*—[Sealed 1st August, 1849.]

This invention consists, firstly, in employing waterproof cement in the manufacture of emery paper, emery cloth, and other scouring fabrics; and, secondly, in manufacturing emery paper, emery cloth, and other scouring fabrics, with the scouring materials on both sides thereof.

The cementing matter heretofore employed in this manufacture has been glue, with other material, mixed or dissolved in water; consequently, when the scouring paper or fabric has been subjected to damp, it requires to be dried before being used; and so liable are the ordinary scouring fabrics to absorb moisture, that it is customary to dry them before attempting to use them; but, when the scouring paper or fabric is made with waterproof cement, it is not so prejudicially acted on by moisture. The composition of the waterproof cement may be varied; but the patentee prefers to prepare it as follows:—Into 3 parts, by weight, of hot boiled linseed oil, 2 parts of strong African copal, in a melted state, are poured; then 1 part of lac, 1 part of Venice turpentine, 1 part of Venetian red, $\frac{1}{20}$th part of Prussian blue, $\frac{1}{20}$th part of litharge, and 1 part of dissolved India-rubber, are added; and all the ingre-

dients are thoroughly mixed together: if the cement should be too thick, it may be brought to the proper consistence by mixing "a stiff boiled linseed oil" therewith. This cement is to be spread evenly over the paper or fabric, and the emery powder, glass powder, or other material, is to be applied thereto in the same manner as when using glue and other material.

In carrying out the second part of the invention, the cement and scouring matters are applied to both sides of the paper or fabric,—"the object being to save fabric and add to the convenience of use; for there may be a coarser and a finer surface produced, or both sides may be of the same character."

The patentee makes no claim to the waterproof cement; nor does he confine himself thereto. He claims, Firstly,—the manufacture of emery paper, emery cloth, and other scouring fabrics, by employing waterproof cement. Secondly,—the making of emery paper, emery cloth, and other scouring fabrics, by applying the scouring materials on both sides.—[*Inrolled February,* 1850.]

To John Hosking, *of Newcastle-upon-Tyne, engineer, for an improved pavement.*—[Sealed 6th September, 1849.]

This invention consists in producing an improved kind of pavement, by forming the foundation wholly or in part of blocks of wood, having parts (which the patentee terms teeth) projecting upwards from the general surface thereof, and then surrounding and covering the projecting parts or teeth of the blocks with pieces of stone, asphalte, concrete, or other materials heretofore used for making roads.

In Plate VIII., fig. 1, exhibits a mode of forming the foundation of a pavement according to this invention; and fig. 2, is a transverse vertical section of the improved pavement. *a, a,* are blocks of wood, tile, stone, or other suitable material, which are laid in rows, parallel to each other; and each block has a passage or channel formed lengthwise through the same, with small horizontal and vertical passages extending therefrom to the sides and bottom surface of the block, for the purpose of drainage. *b, b,* are blocks of wood, which are inserted between the rows of blocks *a, a*: they are formed with shoulders, which rest upon the shoulders of the blocks *a, a*; and they project above the upper surfaces of those blocks. *c, c,* are blocks of wood, brick, or other material,

which are of the same height as the blocks *a, a,* and are placed between the blocks *b, b,* in order that a space may be left between the adjacent ends of the blocks at the upper part of the same. After the foundation has been formed in this manner, the pavement is completed by the application of small pieces of stone, asphalte, concrete, or other suitable materials, in such manner as to fill the spaces between and to cover the blocks *b, b,* as shewn at fig. 2.

Fig. 3, represents a modification of the foundation above described. In this case the small blocks *c, c,* are dispensed with, and the spaces between the upper part of the extremities of the blocks *b, b,* are produced by the upper part or "tooth" of each block *b,* being cut away or reduced in length, as shewn.

Fig. 4, exhibits another modification of the foundation, composed entirely of the blocks *b, b,* which are formed with enlarged bases, so as to leave a marginal space around the tooth of each block, and thus (when the blocks are laid in their proper places) to produce the requisite spaces between the teeth for the reception of the stone, asphalte, concrete, or other material.

It is stated that a pavement constructed according to this invention will possess the advantages of the wooden and macadamized pavements without their disadvantages; as it will not at any time become slippery like the wood pavement; and the teeth or upper parts of the blocks will protect the small pieces of stone or other material from the grinding action of the carriage-wheels to which the materials that form the surface of a macadamized road are commonly subjected.

The patentee does not claim any of the parts separately, nor the precise form or dimensions of the blocks shewn; but what he claims is, the invention of a pavement having a foundation made wholly or in part of wood, having teeth projecting upwards from the general surface, and surrounding and covering those teeth with asphalte or any of the materials above described, or which are in general use for the surface of pavements of a like kind.—[*Inrolled March,* 1850.]

To James Mulbery, *of Parkersburgh, in Chester county and State of Pennsylvania, in the United States of America, machinist, for certain improvements in the slide-valves of steam-engines.*—[Sealed 4th July, 1849.]

The object of this invention is to render the slide-valves of steam-engines, and especially those of locomotive engines,

more perfect in their action, by constructing them in such manner that they shall continue for a longer time than usual with the rubbing surfaces thereof in that complete and steam-tight state in which they are delivered from the manufactory.

The valves and valve-facings or seats, of the ordinary construction, soon become deeply scratched or grooved in a direction parallel with the line of motion of the valve; and, in proportion to the inequalities produced, does the steam pass through the valve without producing any useful effect on the piston. This scratching or grooving is generally supposed to be caused by some hard substance getting into the valve-chest through the steam-pipe; but the patentee says, he has ascertained that it arises chiefly, if not solely, from particles of metal detached from the valves and valve-seats. The openings from the rubbing surfaces have been heretofore made at right angles with the plane in which the slide-valves move; in consequence of this, the edges of the openings soon yield, from want of side support, to the friction and pressure to which they are subjected; and the small particles which are detached therefrom, becoming jammed between the valve and the seat, cause the same to be scratched or grooved. Now, this invention consists in flattening or rounding off the edges or corners to such an extent that they will not be more liable to abrasion than the other parts of the valve and valve-seat or facing. The mode of carrying out the invention is shewn by the sectional figure in Plate VIII., where *a, a,* are the steam-ports of the cylinder of a locomotive engine; *b,* is the exhaust passage; and *c,* is the slide-valve. On examining this figure, it will be seen that the edges of the valve and of the steam and exhaust passages are flattened or rounded off.

The patentee claims, as his invention, making the corners or edges of the openings in the slide-valves of steam-engines rounded or flattened instead of angular, as before described.—[*Inrolled January,* 1850.]

To Reuben Plant, *of Holly Hall Colliery, near Dudley, in the county of Worcester, coal-master, for improvements in making bar or wrought iron.*—[Sealed 18th July, 1849.]

This invention consists in a method or methods of regulating the heat of puddling furnaces employed in the manufacture of bar or wrought iron.

In Plate IX, fig. 1, is a vertical section, and fig. 2, a horizontal section of a puddling furnace constructed in a suitable

manner for carrying out this invention. *a*, is the fire-place; *b*, is the puddling chamber; *c*, is the preparatory chamber for heating the metal before it is operated upon in the puddling chamber; *d*, is the fire-bridge; and *e*, is a damper (by preference, a water or fire-brick damper) for shutting off the communication between the fire and the puddling chamber. *f, f, g, g, h, h*, are tuyeres, or, as the patentee terms them, "tweers," inserted in the top of the furnace: those marked *f, f*, are for introducing blasts of hot or cold air; *g, g*, are used for admitting steam into the puddling chamber; and *h, h*, are employed for introducing steam into the preparatory chamber. For a puddling furnace of the ordinary dimensions, there should be three lines of tuyeres across the top of the furnace, each line consisting of three tuyeres, and each tuyere being one inch in diameter: the line furthest from the chimney should be the tuyeres for the blast, and the other two lines the steam tuyeres for the puddling and preparatory chambers. The blast is to be at a pressure of one pound and upwards on the square inch; and the steam is used at a pressure of ten pounds and upwards on the square inch. The blast should be introduced at the top of the puddling chamber, just behind the fire-bridge, in a slanting direction, so as to drive the flame, as it enters the puddling chamber, down upon the whole surface of the iron; the steam from the tuyeres *g, g*, should be introduced as nearly as possible at the same place, so as to fall in like manner at once upon the whole surface of the iron in the puddling chamber; and the steam from the tuyeres *h, h*, should be admitted just over the part where the puddling chamber terminates and the preparatory chamber commences, so as to fall in the same manner upon the whole surface of the iron in the preparatory chamber. The tuyeres *f, f, g, g*, might be placed obliquely in the sides of the fire-chamber or puddling chamber, or at a part of the top of the furnace nearer its end than the line of division between the fire chamber and puddling chamber; and the tuyeres *h, h*, might be placed obliquely in the sides of the preparatory chamber; but the patentee prefers that the tuyeres should occupy the positions shewn at fig. 1. It is stated that by means of the above arrangements the heat of the puddling and preparatory chambers can be regulated with great nicety without the employment of the damper usually inserted in the chimney of a puddling furnace.

The following is the mode of working the furnace according to this invention:—The chambers *a*, and *b*, are to be charged

with fuel and metal respectively, in the usual manner, and the blast of the tuyeres *f, f,* put on. When the metal in the puddling chamber is melted, the blast is to be shut off, and steam introduced through the tuyeres *g, g,* until the iron boils. The steam is then to be turned off, and the blast is again brought into action till the iron appears above the cinder. The blast should now be shut off, and the iron finished by the ordinary draft in the usual manner, or the heat may be raised and lowered, as required, in the way above described. The damper *e,* over the fire-bridge, is to be raised or dropped from time to time, to increase or lower the heat of the puddling chamber, as may be found requisite, When the iron in the puddling chamber is nearly ready for balling, the next charge of iron to be puddled should be placed in the chamber *c,* and kept just below the melting point by the admission of steam from time to time through the tuyeres *h, h;* and as soon as the puddling chamber has been emptied, the iron is to be pushed from the chamber *c,* into the puddling chamber. The patentee states that he prefers to use hot blast with white iron, and cold blast with grey iron; although either kind of blast may be advantageously used with either kind of iron.

This invention may be applied to puddling furnaces of the ordinary construction without much alteration or expense, as shewn at fig. 3, (which is a longitudinal section of the furnace) where *f, f, g, g,* indicate the blast and steam tuyeres, and *e,* is the damper used instead of the ordinary damper in the chimney of the furnace.

The patentee says he does not claim the application alone either of blast or steam in the working of an ordinary puddling or other furnace; nor does he confine himself to the details shewn and described above, so long as the peculiar character of his improvements be maintained. He claims, as his improvements in making bar or wrought-iron, the use of hot or cold blasts with steam-jets, and hot or cold blasts with the said damper *e,* or with the ordinary damper in the draft of the chimney, to regulate the heat in the said puddling-chamber; and he claims the use of hot or cold blasts and steam-jets, and steam-jets by themselves, to regulate the heat in the said puddling and preparatory chambers respectively, instead of the ordinary damper.—[*Inrolled January,* 1850.]

Scientific Notices.

ON DECORATIVE ART.

In a former paper, on "the proposed exhibition of the products of industry of all nations," after enunciating, in a very general way, a means of ascertaining the relative values of the various results of ingenuity and skill which might be expected to be presented for the consideration of the commissioners appointed to carry out this great undertaking, we, somewhat rashly, made a kind of promise which the present paper is designed to redeem, viz., to shew the connection which should subsist between the fine arts and the manufactures. This is a subject which we approach with diffidence; because we find we have little sympathy either with the opinions expressed by the generality of writers upon art, or by the orators at Art Union and other like gatherings, as to the power of the fine arts to refine and exalt the human mind, and render it superior to the petty wants of a plodding existence. Indeed, with a few exceptions, we think that the orators and writers themselves have no very clear idea of the nature of their own belief. They may not, perhaps, in their desire to raise the nobility of art, go to the extent of Ruskin, in accepting it as "the common consent of men, that whatever branch of any pursuit ministers to the bodily comforts, and regards material uses, is ignoble;" and yet their notions must be very much akin to an opinion which we find rather dogmatically expressed in one of Shenston's letters (written some hundred years ago), that "it is altogether unquestionable that taste *naturally* leads to virtue." It is, we suppose, upon some such hint as this that the zealots for the encouragement of art manufactures, or manufactured art, would fain enter into competition with the teachers of morality and religion for the regeneration of mankind; and, as a counter-cry* to that for building churches, would proclaim the proper appreciation of decorative art as the healing balm to fallen humanity. Now, although we are very willing to admit the mental superiority of any man possessing a refined taste for the beautiful, over one who could gaze unheedingly upon the ever-changing loveliness of nature, yet we cannot concede that the former must of necessity be a more virtuous, happy, or useful member of society than the

* The reader is requested to observe, that the word "counter" is not intended to refer to any mercantile views, which some of the most zealous advocates for the advancement of the public taste are slanderously reported to entertain.

latter, however he may surpass him in agreeableness of conversation. The power of appreciating the beautiful in form is, we believe, a natural gift, universally bestowed, but in various degrees, and capable of growth or decay, by cultivation or neglect, like physical strength, or the perception of sound; and, like these, its abundance or deficiency in the individual can affect him only: whereas, a lack of moral perception entails evil upon society generally. Our view, therefore, of the benefit to be derived from the fine arts is, that the individual who makes them his study will thereby develope in himself a most fruitful source of intellectual gratification; but that this pursuit cannot, from its inherent worth, lead to his moral advancement. We preface our observations on decorative art with these remarks for the purpose of removing, at the outset, the impression, if such should arise, that, led away with a love for the fine arts, we are writing, as too many do, under the guidance of the imagination rather than of reason, and are therefore setting a factitious value upon ornament as opposed to utility. Decoration we consider to be the means whereby man supplies to his own works somewhat of that agreeableness which he sees pervading nature, and which he feels is needful to his happiness. It is natural for us to yield a ready admiration for whatever approaches most nearly to our idea of completeness or perfection; because we experience a sense of pleasure from the knowledge of the fact that little or nothing is wanting in the object we are contemplating that might, with advantage, be added; but no sooner do we perceive the existence of a palpable deficiency than we experience an involuntary sensation of pain, which is exactly proportionate to our appreciation of the extent of the defect that we have discovered. Thus every healthy mind is distressed by a display of the vacuity of intellect in the idiot, or the feebleness of the paralytic; and so for a like reason is a blank naturally repugnant to the visual organs of every reflecting being;—for, accustomed as we are to an exuberant variety of form and color in nature, our eye, whether it alight intelligently or not upon her beauties, will unconsciously run over the play of lines which she exhibits, and dart from tint to tint, communicating, by the physical action of the parts which are brought into exercise, a pleasing impression to the mind.* That the love

* "Man is gifted with a variety of organs that enable him to approach the most distant objects, to discern their qualities, and to convert them to his own use. Whatever exercises, without straining or relaxing these organs, has a salutary tendency, and is accompanied with an agreeable sensation."—*Theory of Agreeable Sensations.*

of ornament is innate in man there can be little doubt, when it is remembered that every savage nation employs it on each of their scanty branches of manufactures, viz., their weapons, their dresses, and their mats. It is evidently a physical want, then, which we attempt to supply when (in architecture, for instance) we overlay a barren surface with decoration, of however humble a character,—we desire to remove from contact with the eye the cause of a disagreeable impression, which, although disregarded by the casual observer as insignificant in comparison with what are designated "real troubles," will, when conjoined with these, add poignancy to the sufferer's grief, as is exemplified by Hood's poverty-stricken sempstress, who, in the midst of her cares, touchingly adverts to the desolateness of her home, with

> "——— a wall so blank, my shadow I thank
> For sometimes falling there."

Ornament, then, although subservient in importance to Utility (as taken in its commonly-accepted sense), possesses, as we believe, a special and peculiar use, viz., to reconcile the material utilitarian works of man with his knowledge of beauty, as intuitively possessed and developed by the continual observance of the perfection of nature. So natural, indeed, to man is the desire for decoration, that its absence from the domestic hearth, or, in fact, wherever the enjoyment of ease and recreation are expected, will, we think, almost invariably be felt. Where, however, a stronger and uncongenial feeling is allowed to take possession of the mind, like that which chains the merchant to his counting-house, or engrosses the thoughts of the artizan at his bench, it is manifest that outward circumstances will pass unheeded;—all places, therefore, which are set apart for labor, should, as a principle, be devoid of ornament. If nothing else were lost by disregard to this principle, the pleasing contrast between the scenes of labor and of home joys would be at least diminished.

Having shewn that the power of appreciating ornamental design is not an acquired but a natural faculty, and having defined the proper field for the development of this branch of the fine arts, we shall proceed to examine into the composition of ornament, with the view of ascertaining whether any principles may be adduced to assist the designer in his labors, and assure to him the approval of men of taste. But, to prevent misunderstanding, we will just remark, that under the word *ornament* we include the result of any honest attempt, whether skilful or not, to cover a plain or blank surface with a pattern, providing that pattern is not the representation of

a repulsive object; such, for instance, as "a death's head and cross-bones," which is likely to call up unpleasant associations. Now, whatever of ornament proceeds from the hands of man, is either the transcript of what he has seen, or the combination of parts represented in nature;* the greatest achievement, therefore, of which he is capable, is a skilful combination; and, in exact proportion to the height of his aim (the presence of ability being pre-supposed), will be the amount of his success in designing: for ornament is not merely physically appreciable (as we have already attempted to shew), but it is also capable of conveying to the mind, by unmistakeable symbols, sentiments and ideas without end, and that with a delicacy and truth that would well nigh rival the poet's pen. It is, we believe, to the too general want of discernment of this power, both by the public and the artist, that the present degradation of ornamental design is alone attributable. Our decorators, for the most part, are satisfied either with an agreeable play of unmeaning lines, appropriately counterbalanced, as exemplified by the Renaissance style, or with a simple harmonious rendering of color, neither of which can receive more than a physical appreciation; but, if we look to the memorials of the ancient Egyptians, we shall see that almost every ornament had its appropriate metaphorical signification; and so again do we find instances in the treasures with which Mr. Layard has furnished us, that the Assyrians appropriated ornament to its highest use. In making these remarks, it is not our wish to depreciate one branch of decorative art for the undue elevation of another; for this is not an age to cover our walls with hieroglyphics,—yet we would desire to see decorative art again assume its suggestive or poetic character, and made capable of speaking to the mind as well as to the eye. This must, however, be the exceptional and not the prevailing characteristic of decorative art; for the public taste will require to be raised to a far higher standard before symbolic art is extensively adopted.

With respect to that lower or inferior order of decoration which can be appreciated without the mind being thereby called into exercise, we think a few plain rules might with advantage be laid down for the guidance of the designer; for, as little fancy or imagination is required of him in this branch of the art, rules cannot cripple his work; but, if they are judicious, he may be restrained from producing those

* If this assertion should be disputed by any reader, we beg to refer him to Vol. II. of Mr. Ruskin's work, "Modern Painters," where the point is ably discussed, to demonstration.

crude abortions which are too frequently displayed in every branch of art manufactures. Let us see, then, what may be done to this end. For the subject of our remarks, we will select—paper-hanging, and see how the pattern of that manufacture should be composed. The design we will assume is a sprig or a star, the repetition of which, following in parallel lines, covers the paper; but, if this is *all* the pattern, it is manifestly incomplete,—for, as we cannot divest our minds of the fact that all bodies are composed of ponderable matter, so it is manifest that, to give truth to the representations of those bodies, we must indicate their substantiality. And how is that to be done, when the repetition of an isolated design forms the pattern? When applied to a wall, the sprigs or stars will be hanging in mid air, without any means of support; it is therefore essential to provide a means of sustaining them. This may be done by running a kind of net-work over the paper, so as to connect the sprigs or stars together; and thus a degree of unity and stability will be given to the pattern. It is needless to remark that this simple concession to common sense is scarcely ever regarded by our designers, from the belief perhaps that their works, like Prospero's, are but insubstantial pageants. Again, if a large group of flowers (set in a vase or basket, as is not unfrequently the case) forms the main feature of the design, means, architecturally sufficient and appreciable by the eye, must be shewn, for carrying the supposed weight of the matters forming the decoration; or else truth will be sacrificed, and the design must fail in its effect. In fact, all representations of matter must, equally with the substances of which they are the type, conform to natural laws, and not lie against the surface they are intended to decorate as if they hung there by the powers of suction.

There is one peculiarity belonging to ornament which has, we think, been quite overlooked by our modern designers, viz., that when, from its form and isolated position, it is capable of being received in its entirety on the retina of the eye, its frequent repetition becomes unpleasing,—approaching even to disgust. This peculiarity was evidently well understood by the Moors, who carried the order of decoration, which we are now considering, to the highest pitch it has ever attained; for, if we refer to Owen Jones' or Lewis' illustrations of the palace of the Alhambra, we shall find that isolation was always eschewed, while repetition of design was the rule of their working. If, then, we admire Moorish wall-painting (and who would refuse to assent to its beauty?) it is not by reason of a design being repeated that the eye is offended; on the contrary,

not a few of the classical borders which are in general use at the present day owe their beauty entirely to repetition,—the pattern being composed of two or three simple forms, as an oval, or a lotus, with a filling up between the spaces of the repeat: a solution, therefore, of this seeming enigma must be elsewhere sought. For this purpose, let us examine the style of treatment employed by the Moors in the Alhambra palace. In the piazza of the "Court of Lions," the space immediately above the turn of the arches is occupied throughout with an endless repetition of one simple pattern, somewhat resembling a "four-leaved shamrock;"—we are not left, however, to the misery of attempting to count them, or of imagining how they are kept in their places upon the walls; for a bold lattice-work, filling the spaces between the repeats, leads the eye up to a terminal horizontal line near the roof, and throws back the pattern into sunken panels. In none of the examples is the eye allowed to fix upon one spot and isolate a portion of the design; but a structural truth and unity is always maintained; and, where the repeats are not knit together by prominent interlacing and continuous lines, they are formed so as to fit together like the pieces of a puzzle, and produce a uniformity of pattern; or they are arranged so as to produce, together, a new design.

Here then are some principles which display themselves, while we are yet upon the threshold as it were of the enquiry; and although they do not possess an application extending through all branches of art manufactures, they nevertheless serve to shew that the labors of the decorative artist may be greatly aided by a reference to first principles; for what we have said of structural truth, with respect to the ornamenting of walls, is equally applicable to roofs and ceilings: and so likewise is unity of design essential in tessellated and other ornamental pavements or floorings; although the question of support is not, in this instance, brought into the account.

With respect to the decoration of plates, dishes, ewers, and the like kind of domestic articles, whether made of earthenware or the finest porcelain, we are inclined to believe (but we would not lay it down as a rule) that iterations of a simple design, such as those employed by the Greeks in friezes, or those found on the Etruscan vases, are alone admissible. At any rate, there is this disadvantage in applying to such articles an isolated design, having pretension to artistic value, viz., that its repetition, or the substitution therefor of something assimilitating to it in character, will necessarily be required, in order to make up "sets" of the same pattern; and thus the pleasure which a first inspection of the design might be

calculated to create, would most certainly be neutralized or destroyed by multiplication.* Of this, however, we are quite sure, that porcelain is not a suitable medium for landscape painting, or for figures or groups requiring expression; for the unsatisfactory effects (in an artistic point of view) as yet attained—and that not so much the result of want of manipulative skill in the painter as the defective character of his materials, the special imperfections of which we cannot now stop to examine—is sure to deter the imaginative artist from subjecting himself to such disadvantages; and of what service is the mere copyist, shackled too in his confined walk, to illustrate the beauties of nature and the subtleties of human expression? Porcelain painting will therefore, as we think, be wisely confined to that division of the decorative art which we have designated as being merely physically appreciable; and, if figures are desired, let them be either grotesque or classically inexpressive,—that is, exhibiting merely the generic human form (as we find them upon the Etruscan vases), and constituting either a central feature of a continuous design, if for a shallow vessel, as a dish; or for a vase, forming a belt round the body thereof, and bordered above and below with a repetition device.

We cannot close our remarks upon decorative art (although we have occupied more space than we at first intended) without saying a few words upon the second order of ornament, which we have defined to be suggestive or mentally appreciable. Upon this kind of decoration much might be written; but we must touch upon it, for the present at least, with even more brevity than we have used in dealing with our first division.

Suggestive ornament or decoration, from requiring somewhat of the creative powers of the real artist, treads so nearly upon "high art," as it is termed, that we can scarcely draw the line between them; but, in the following remarks, we shall strive to keep within the limits we have proscribed. Under this division or order of decorative art we include all designs capable of conveying an unmistakeable impression to the mind. Of these there are three distinct classes:—1st, the arbitrarily symbolical, as heraldic emblazonments; 2nd, the

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* A proof of this assertion will be found in the value set upon the engravings issued by Art Union Societies, or indeed upon any work of art supplied to the public in an unlimited number. The solution of the question—Why are Art Union prints so little esteemed? is most erroneously assumed to be—the want of ability in the engraver employed; whereas, it results almost wholly from a natural cause (a defect, it may be, in man's nature), viz., that endless repetitions, whether perceived by the eye or the ear, invariably tend to produce in the mind a feeling of aversion, instead of pleasure.

naturally symbolical, as the winged bull of the Assyrians; and 3rd, the associatively symbolical, as the inverted torch, which, applied to sepulchral monuments, is emblematical of death. These again are capable of uniting with each other, and thereby forming a series of mentally appreciable pictures to an indefinite extent. The third class, or the associatively symbolical, is capable of a sub-division, viz., into grave and gay. Of the grave we have already given an example; and, for the gay, we may cite the well known ecclesiastical decoration in Christ's Church, Hampshire, of the fox installed in a pulpit, and preaching to a congregation of geese. It will be obvious, from what we have said with respect to the ornamenting of porcelain, that, under this order, repetition must be very sparingly indulged in; and that the more rarely as the design approaches to a fine art production. Even the repetition of heraldic devices should, we think, be confined as much as possible to differences of local application. Thus, every article of furniture in a building might bear with propriety the owner's coat of arms or crest; but we cannot approve of the taste which dictated the profuse display of the same heraldic device a thousand times over in the House of Lords;—to say the least of it, a poverty of invention in the architect is thereby indicated: we make the same objection to the lamb and flag decoration which covers the roof of the Temple Church.

Respecting the modern employment of the three classes of symbolical design above enumerated, we may say that the first is in the greatest demand; because, through heraldry, it ministers to the exaltation of self. The second class is seldom, if ever, brought into requisition,—for it is usually set down as an indication of barbarism; although we have sufficient proof in the Scriptures that this was the most powerful, if not the only, means of conveying to man's finite understanding the predetermined workings of the Infinite. For the application of the third class, there is a somewhat larger demand; but that is almost exclusively confined to the expression of sadness; its aid being sought to express the grief of survivors for departed friends. In this class alone can the moderns be said to excel, and that in a very limited degree; for no sooner is a happy thought for a sepulchral monument depicted, than we see a host of copies huddled together in stone-masons' yards, or, perhaps, temptingly displayed in our accustomed line of walk, awaiting merely our decease, and the generosity of our friends, to be set up as an appropriate memorial of our own departed worth. The mingling of the classes is sometimes advantageously effected.—

The principle application of this mixed class is to the decoration of book-covers; and for such a purpose it is admirably suited. As a conclusion to the present paper, we will give an example, which we find on the back of Mr. P. J. Bailey's poem of "Festus," as it clearly shews the power of symbols to express what even words must fail adequately to convey. The text which the artist has selected for illustration is, "I saw Satan, as lightning, fall from Heaven." We know how miserably great artists have failed in their attempts to compass this almost inconceivable subject,—but who will say the symbol fails? For Heaven, the more immediate abiding place of the Holy Trinity, we have the conventional figure △ from which darts downwards forked lines of lightning, striking the recoiling serpent. Nothing is wanting, as we conceive, to the perfect embodiment of the text; and we question very much whether the minute details of Milton do not rather tend to weaken than add vividness to the force of the original expression. In this example we find an illustration of the three classes combined; the △ and the lines of lightning being arbitrary symbols of the first class; the serpent, naturally subtle, and therefore symbolical of sin, being of the second class; and the whole together being associatively symbolical and pertaining to the third class.

In closing this hasty notice of decorative art, we must say, that for the real artist we can hardly hope to have put forward anything of value; but we think that, to the mere designer, we may, perhaps, have opened up some points which are deserving of his attention, as preservatives against inadvertent error, and also as suggestive of higher aims for his future career.

REPORT UPON THE MANUFACTURE OF CERUSE OR WHITE LEAD, AS REGARDS ITS EFFECT UPON THE HEALTH OF THE WORKMEN: PREPARED FOR THE ACADEMY OF SCIENCES, PARIS.

BY M. COMBES.

[Translated for the London Journal of Arts and Sciences.]

THE maladies to which manufacturers of white lead, as well as those who are engaged in preparing or using pigments or other preparations having lead for their base, are peculiarly liable, have for a considerable period excited the attention of scientific men, and particularly that department of the government having the public health more especially under its care.

It is well known that, in 1783, Guyton Morveau proposed to substitute zinc white for white lead in the preparation of pigments; but all attempts made for that purpose, from that period to the present time, have in great part failed, either from the high price of the zinc white, or from other causes, which form

no part of the subject under discussion in this report. M. Leclaire recently undertook the manufacture of oxide of zinc on a large scale, in order to apply it to painting vessels and to other purposes.

On that occasion statistical documents, extending over a considerable period, and collected from the hospitals of Paris by the Council of Health of the Department of the Seine, touching the maladies under which workmen using lead or preparations of lead suffer, were very extensively circulated. From these documents we learn that, during a period of ten years (*i.e.* from 1838 to 1847 inclusive), the hospitals received 3,142 patients, of which number 1,898 came from two manufactories of ceruse or minium, in the Department of the Seine. MM. Théodore Lefebvre & Co., and Poëlmann Brothers, manufacturers of ceruse on a very large scale, in the environs of Lille, struck with the injurious effect it must necessarily have upon their business, addressed to the Academy certificates from medical men, and a report from the central Committee of Health, in the Department du Nord, stating that, in consequence of the improvements made in the process of manufacture, and the attention paid to the health of their workmen (150 in number), none of them had been attacked with cholic for upwards of a year. MM. Lefebvre and Poëlmann concluded, by requesting the Academy to verify the facts by means of a Commission, to be appointed for that purpose.

In order to carry out this object MM. Lefebvre and Poëlmann's manufactory was visited, and also the white lead manufactories in the Department of the Seine, and all those in the environs of Lille, one only excepted. From the information thus gathered we shall shew the various improvements introduced into many of these establishments, and at the same time point out what is further requisite. We generalize our observations, leaving to the proper authorities the task of prescribing to each manufactory the improvements necessary for the health of the workmen, persuaded, as we are, that a sense of humanity will prompt the manufacturers to anticipate any orders to that effect.

White lead is generally manufactured in France by what is called the Dutch process; in a manufactory at Clichy, however, the French process (established by M. Roard, according to the instruction of M. Thenard), is partially used, for the purpose of improving the carrying on of a portion of the manufacture which it is very difficult to deprive of its injurious effects, viz., the preparation of oxide of lead or massicot in reverberatory furnaces. A very strong draft even is insufficient to protect the workman against the plumbic vapors; as they are constantly occupied in stirring or raking the oxide of lead formed, in order to lay bare the surface of the metallic bath. The succeeding operations, up to the potting of the white lead, are innoxious,—being performed by the wet method. The processes of drying and pulverizing the cakes of white lead are common to all modes of manufacture.

The Dutch process comprises the following operations:—1st.

Fusion, and casting of the lead into plates of any required thickness, or into bars of a long rectangular form. 2nd. Laying the lead in alternate layers with dung or tan. The lead is placed upon pots containing dilute acetic acid. It remains in the chambers thus filled for from thirty-five to forty days when dung is used, or from sixty to ninety if tan be employed. 3rd. The layers of lead (converted for the most part into carbonate) are now successively uncovered, and the white lead formed is removed from the metallic lead; after which, the white lead is ground and sifted, in order to remove any portions of metallic lead which may be mixed with it. 4th. Grinding up the white lead with water. 5th. Moulding and drying. 6th. Pulverization and dry-grinding of the cakes of white lead; sifting, and packing into casks, the white lead intended to be sold in the state of powder. 7th. For white lead which is intended to be sold in the state of paste, mixed with oil,—mixing the powder produced by the dry-grinding (without previous sifting) with from 7 to 10 per cent. of its weight of oil. The mixture is effected in a close vessel, by means of an agitator; after which it is passed through several pairs of cast-iron rollers. The fine homogeneous paste, thus produced, is received in a vessel containing water, from which it is taken and put into casks for sale.

1st. *The melting of the lead.*—This is performed in a cast-iron vessel, and no hurtful vapors are produced unless old lead be introduced, which has been used in previous operations, and is therefore covered with a layer of carbonate. In well-conducted establishments the melting vessel is placed under a flue or funnel, in communication with the chimney of the furnace, or any other chimney having a good draft. The platform of the furnace is connected with the flue or funnel by means of an outer casing of iron, of any convenient shape, and having doors or openings for the purpose of supplying the lead to be melted, or running the melted metal into moulds. These precautions appear to us to be sufficient to protect the workmen from injurious vapors. Besides, the melting of the lead is only effected at very long intervals.

2nd. *The placing of the sheets or bars of lead in alternate layers with dung or tan.*—From this operation the workman is not in the least exposed to injury. In all the French manufactories, one only excepted, the lead is cast in sheets; and in each of the pots containing acetic acid is placed a thin sheet, rolled in a spiral form, and bearing upon two supports near the bottom of the vessel. In one of the manufactories in the Department of the Seine, the lead is cast into bars, which are placed in beds, upon pots of less depth than those generally employed, and which do not contain rolled lead.

3rd. *The separation of the carbonate from the metallic lead, and the pulverization and sifting of the same.*—These operations constitute the most injurious part of the manufacture. In all the establishments which we visited, with the exception of one, these operations were performed as follows:—The workman first

detaches the large scales or crust of white lead, which adhere very lightly to the metallic lead; he then takes in his hands the sheets of lead covered with ceruse, unrolls those which were placed in the pots, twists them about in various directions, and puts on one side the detached scales. This operation, which is called picking (*epluchage*) in the Department du Nord, is sometimes performed in the place where the layers are formed, and sometimes in another, into which the sheets covered with white lead are carried, just as they come from the beds. The picking operation, in which the operator has his hands constantly covered with carbonate of lead, is not, however, the most unhealthy part of the manufacture, as the white lead is detached in thick scales, which produce very little dust; but the sheets of lead are still partially covered with some portions of white lead, which adhere very firmly.

The old method of detaching these was by placing a pile of the sheets of lead upon a slab of stone, and striking the lead with a wooden beater; by this means the white lead was caused, either to fall off in the shape of minute scales, or else it rose in the shape of dust into the air, and was respired by the operator. This operation, which is still carried on after the old method in some establishments, is called scouring (*decapage*) in the Department du Nord; but when so conducted, is extremely injurious to health. The scouring operation is now, in many manufactories, performed by mechanical means, which render it much less injurious than heretofore. The sheets, covered with adherent white lead, are carried in a hand-barrow to the scouring machine, and the operator takes them, one by one, and lays them carefully on a travelling endless-cloth, by which they are carried to the top of an inclined plane, down which they slide to an arrangement of apparatus, consisting of two pairs of longitudinally-grooved pressing-rollers, beyond which an inclined sieve is situated. Between these rollers the sheets of lead are made to pass, in order to detach the white lead therefrom. When the sheets of lead have arrived at the lower part of the sieve, they are received into a wagon, and pass away into a contiguous chamber. The white lead, which is detached from the sheets of lead, falls from the rollers upon a travelling-cloth, and is conducted to a hopper, together with the white lead which falls from the sieve; and the whole is delivered by the hopper into a wagon, placed in a chamber having closed doors. All the parts of the apparatus are enclosed in wooden cases, which are kept shut during the working; there being but one opening, viz., that for allowing of the operation of the endless cloth, which feeds in the lead. The wagon containing the white lead is run out of the chamber as soon as the operation is completed and the dust has ceased to fly about; and its contents are added to the products of the picking operation, in order to be submitted to dry-grinding. This latter operation is mostly performed with vertical stones, turning in horizontal troughs. The white lead, when ground, is poured into

the hopper of a fine bolting-cylinder, enclosed in a casing; into which the powder falls after passing through the meshes of the bolting-cylinder. Any scales of lead which may also have passed through the stones, will fall to the bottom of the bolting-cylinder, and from thence into a separate receptacle. The white lead, thus sifted, is mixed with water, and again ground.

In several manufactories in the environs of Lille, the pulverization of the scales is effected by means of several pairs of horizontal cylinders, fluted in a direction transverse to their axes. The substance ground falls on to one or more metallic sieves; after passing through which, it is conducted by hoppers into a chamber, supplied with several jets of water. The scales of lead which cannot pass through the sieves fall into another chamber. The whole apparatus, consisting of grinding-cylinders and sieves, occupies the height of one story, and is enclosed in a wooden casing, furnished with a hopper above, which is kept full of scales of white lead, in order to prevent the dust from rising: the hopper may, if thought desirable, be closed by a trap. This arrangement constitutes one of the most important sanitary improvements upon the old system of manufacture.

In the manufactories of the Department of the Seine, in which the lead is cast in bars, instead of being operated upon in rolled sheets, the picking, scouring, pulverizing, and sifting operations are performed mechanically, by means of successive apparatus, enclosed in one casing, and divided into several compartments, connected together by wooden channels.

The first compartment or chamber contains three pairs of fluted rollers, which effect the picking and scouring of the bars; and also three other pairs, which effect the grinding of the scales. There are two openings at opposite sides of this chamber; one of which admits the endless-cloth, upon which the bars incrusted with white lead are fed in; and the other, through which the bars, after being cleansed, make their exit by sliding down an inclined plane of perforated sheet-iron, which is shaken at intervals by suitable mechanism. On leaving this compartment, they are straightened by beating with a wooden beater, and sorted; those which are fit for use again are selected and put aside; while those bars which are in great part decomposed, are melted and re-cast.

The scales, on being detached by the action of the three pairs of fluted rollers, between which the bars successively pass, fall upon a moveable endless-cloth, extending under the cylinders, and also under the perforated iron plate; this cloth feeds the scales of white lead to three pairs of plain rollers, by which they are ground. The powder falls upon an inclined plane, and from thence into a casing, where it is received into vessels, attached to an endless band, and carried thence to the upper part of a second chamber, united to the first by the wooden channel, in which the endless-band, carrying the buckets, works. This second chamber contains the bolting-cylinder for sifting the white lead, and separating it from any scales of metallic lead which may have become

intermixed with it: these latter are conducted into a separate compartment. The white lead falls to the bottom of the chamber, from whence it is afterwards taken (when the operation is completed and the dust has ceased to fly) and ground with water. In the operation just described, the workmen who receive the bars of lead, on their leaving the chamber, are still exposed to the injurious influence of the white lead powder; they are therefore made to work at this dangerous post by turns—each man being thereby prevented from working consecutive days.

The separation of the scales of white lead from the metallic lead, and the grinding and sifting of the same in a dry state, cannot be considered as salubrious operations under any circumstances; notwithstanding the important improvements which have been made upon the old methods, and the sanitary precautions taken in most of the establishments visited. Thus, the picking by hand of the scales of white lead from the metal, is attended with a certain degree of danger; attempts to obviate which have been made by several manufacturers, by causing the workmen to wear gloves. This precaution is, however, not merely insufficient, but it is attended with disadvantage, as the work cannot be so well performed as by the bare hand.

In the only establishment in which the picking is not manually performed, the bars of lead, on coming from the chamber, after passing through the rollers, still retain some portions of carbonate of lead, which are reduced to fine powder when the bars are beaten straight. This fine powdered white lead escapes from the chamber containing the grinding apparatus, either through the openings made purposely for the passage of the different substances, or through the holes in which the shafts of the mechanism work. All, or nearly all, insalubrity would be avoided in this manufacture, if the separation of the scales of white lead, the pulverization, and the sifting, were performed under water; or, at least, if the ceruse and the residue of lead, on coming from the space occupied by the grinding apparatus, were received upon gratings or sieves, supplied with a number of minute streams of water, by directing a current of water through a perforated plate. According to the information furnished by M. le Play this would appear to be the mode of operation followed in England, where the residues of lead are again melted before being replaced in layers with the tan. We would call the special attention of manufacturers of white lead, and the government, to the importance of a method, the introduction of which appears to be attended with many advantages and but few difficulties; this is apparent from its being generally employed in England. The white lead would, by this means, undergo a washing, which would carry off, at least partially, the soluble salts by which its purity is injured; it is moreover necessary to dilute it with water, to submit it to the following operation

4th. *Grinding the white lead with water.*—The white lead is placed in tubs, and diluted with water, so as to form a soft paste.

It is then passed successively through a series of horizontal stones, by which its trituration is completed. This grinding with water is perfectly innocuous. The workmen do not touch the paste with their hands; they merely pour it into the hoppers above by means of ladles.

5th. *Moulding and desiccation of the white lead paste after being ground with water.*—In all the manufactories, one only excepted, the soft paste is poured into earthen vessels of a conical form, which are exposed to the action of the air in a drying apparatus. By this means, a large portion of the water is evaporated;—the white lead acquires a certain consistence, and undergoes a contraction, by which it is detached from the sides of the earthen pots, and may be easily removed. The desiccation is then completed in a proper drying stove, by means of a current of hot air. The sides of the pots become covered with a layer of white lead, which is ordinarily removed with an iron scraper. This operation is performed by women or children, and is attended with inconveniences, which are sometimes obviated by cleaning the pots with water; this, however, occasions additional expense and difficulty, which may prevent its general adoption. A portion of the white lead is introduced into commerce, after drying, in the form of cakes, which are wrapped in paper, and carefully packed in casks, so as to avoid breaking them as much as possible. The handling of the cakes of white lead cannot be considered to be free from inconvenience, although unattended with danger, if due precaution be observed. In one manufactory in the Department of the Seine, the white lead is not potted as above mentioned. The soft paste is poured from the vats on to a cloth, in which it is wrapped, so as to form a square flat packet. Several of these packets, being arranged in alternate layers, with corresponding pieces of wood, are submitted to the action of a hydraulic press; and, by this means, the water is, in great part, expressed. The cakes are then uncovered, and cut into convenient shapes for the drying apparatus; from whence they are carried to the stove. A small portion of the products of this manufactory is sold in dry cakes; but the same care is not taken in packing these in casks as the conical cakes; for the product is disposed of to parties who are well aware that form is no indication of quality. The cakes are simply thrown into the cask, and packed by means of a cylinder, worked by a hydraulic press.

6th. *Grinding and sifting the white lead preparatory to sending it to market.*—This second pulverization is generally effected by means of vertical mill-stones, revolving in horizontal troughs of the same material. The ground white lead is shovelled into a hopper, leading to a silk bolting cylinder, enclosed in a casing; at the bottom of which the white lead falls in the form of a fine powder. That portion which cannot pass through the silk, falls into a separate case; from which it is taken to be again passed through the mill. When the dust has ceased to fly, the sifted white lead is packed tightly in casks.

According to the above plan, the operations of pulverization, sifting, and packing, are evidently very injurious, by reason of the dust which flies about. The injurious influence may be much lessened by enclosing both the mill-stones and the bolter which receives the ground white lead immediately therefrom in an air-tight case. This has been done in one manufactory in the environs of Lille,—horizontal stones of white marble being substituted for the ordinary vertical stones. Each pair of stones is enclosed in a drum, furnished with a hopper above, in which the cakes of white lead are placed, and undergo a preliminary breaking by means of a striated cone, placed in its interior, and revolving on its axis. The fragments fall from thence into a hopper, fixed above the upper or running stone. The powder ground is thrown out by centrifugal force towards the periphery, where it is received by two openings and conducted to the bolter, which is in a lower chamber, and closed by a double door. In order to avoid the flying of dust during the packing in casks, the white lead is poured carefully into the cask, and packed by means of a pressing-screw, which works a cylindrical plate, a little smaller in diameter than the barrel, and presses it down upon the white lead.

7th. *State of the white lead when sold in the market.*—In the environs of Lille nearly the whole of the products of the white lead manufactories are sent out in powder or in cakes, viz., about two-thirds in powder and a third in cakes. A manufacturer in the Department of the Seine has set up in his establishment a complete workshop for grinding the white lead with oil; and nearly seven-eighths of his products are sold in the state of paste, containing from 7 to 9 per cent. of oil. In this manufactory the cakes of white lead are ground after desiccation in a mill similar in construction to a coffee-mill, and set in a closed chamber,—the white lead being first coarsely pulverized. When the dust has ceased to fly, the powder is to be poured gently into an iron cylinder, placed horizontally,—a small quantity of oil being added. The cylindrical vessel is then closed, and the mixture is effected by beaters, fixed upon a shaft, working longitudinally in the cylinder. A fresh quantity of oil is then added, if requisite; and the mixture then passes between two sets of cast-iron grinders, by which it is reduced to a very fine and homogeneous paste;—this paste is received in a vessel containing water, and is afterwards put into casks for sale. Thus, when the white lead is to be ground up with oil by means of suitably-arranged apparatus, similar to that which we have seen at work, it need not be reduced to very fine powder and sifted; so that one of the most unhealthy of the operations is almost wholly abandoned, and replaced by another, which appears to be perfectly innocuous. It would therefore be very desirable that all the white lead, which, before it is used, must be reduced to paste with oil, should undergo that operation in the course of manufacture; and not in other workshops, where the workmen are exposed to saturnine diseases if suitable precaution be not observed.

It appears certain, from what was observed by one of us in a white lead manufactory at Birmingham, and according to the information which we have received from M. le Play, that the English manufactories sell the greater part of their products in the form of paste, which contains from 8 to 9 per cent. of oil. It would be very desirable to follow out this plan in France.

In most of the white lead manufactories great precautions are taken to preserve the health of the workmen. For instance, they are made, on leaving off work, to wash their hands, arms, and faces. For this purpose, there is a plentiful supply of water and soap, potters' earth, and, sometimes, vessels of water holding sulphuret of potassium in solution. In one of the manufactories in Paris sulphur baths are provided, in connection with the boiler of the engine. As regards the insalubrious portions of the work, the workmen are employed upon them alternately, and very rarely several successive days. A room is provided in some establishments, in which the workmen, on leaving off work, deposit their working dress; and, in almost all, the services of a medical man are provided at the expense of the principal. The workshops are in general spacious and airy, more especially those in which the white lead is ground and sifted. The walls and shafts of the machinery become covered with white lead, even when the grinding apparatus is enclosed; which shews that the pulverizing process must still prove injurious.

From personal observation, and also from information which we have obtained, we are enabled to assert that the general condition of white lead manufactories is not at present so injurious to health as one might be led to imagine from the statistical accounts collected during the last ten years from the hospitals of Paris. There is besides very great difference, as regards salubrity, in the different manufactories which we visited. There was not a single one in which the old processes of manufacture had not undergone some improvement, and in some (we may cite in particular those of M. M. Lefebvre and Co., at Moulins-les-Lille, and of M. Besançon, of Ivry, near Paris) the improvements are very considerable and important. Even in these latter, however, further improvement would be very desirable.

For example, the operations of picking and scouring, and also the pulverization of the dry scales of white lead, have not been rendered perfectly innocuous; for this purpose it would only appear to be necessary to adopt the methods employed in England, and above described.

The manipulation in the process of potting, which, without being absolutely injurious to health, is not without inconvenience, besides causing useless expense, might be dispensed with, if purchasers could be dissuaded from attaching importance to the conical form of the blocks, which in reality it does not possess. If the whole of the white lead which is required to be ground up with oil could be sold in commerce in the form of paste, the inconveniences of reducing the cakes to powder, and packing the

powdered white lead in casks, would be considerably lessened, as well as the causes of the maladies which are contracted in grinding and preparing colors. The carrying of these ameliorations into practical effect does not appear to be attended with any difficulty; but their introduction into manufactories may be prevented, even against the will of the manufacturers themselves, by the prejudices of purchasers, who are wedded to old habits.

In conclusion, the following points seem to be established,—1st. That the maladies to which the workmen in white lead manufactories are liable may be generally prevented by the substitution of mechanical processes for the manual operations, wherein the workmen are obliged to handle the white lead, as in the following instances:—By the employment of water in the separation of the scales from the residue of lead, and the pulverization and sifting of the scales of white lead. By the substitution of moulding in the form of prisms or bricks, in potting the white lead ground with water. By grinding with oil, by suitable apparatus, during the process of manufacture, such portions of white lead as require to be submitted to that operation before being employed. By enclosing in chambers separated from the workshops all the mechanism necessary for the pulverization and sifting of the white lead, when those operations are indispensably necessary. The dust might be prevented from passing through the openings necessary for the introduction of the materials, and for the working of the shafts of the machinery, by means of currents of air directed towards the interior of the chambers, which must be for that purpose surmounted by a pipe in the form of a chimney, rising above the roof; and also by causing the shafts to work in elastic bearings, or in stuffing-boxes kept constantly lubricated. Lastly, these precautions might be completed by a perfect ventilation of the workshops and hygienic precautions which may be readily observed by the workmen. 2nd. That although many ameliorations favorable to health, recently introduced into most of our white lead manufactories, have considerably reduced the amount of sickness, there is yet much to be desired, especially as regards the separation of the scales of white lead from the metal, pulverization, and sifting, which precede the grinding with water.

As the commission with which we were charged by the Academy was simply to examine in what respects the white lead manufacture affected the health of the workman,—the casualties therefore resulting from the employment of this substance in the various arts, and the means of preventing them, although of great importance, has formed no part of our enquiry.

With respect to the manufacture itself, your commissioners are of opinion that very important improvements have been effected in relation to the health of the workmen, and that this will cease to be an unhealthy occupation, when it shall be carried on by the improved methods and with the precautions pointed out in this report.

ON THE NATURE OF THE DIFFERENT KINDS OF COPAL FOUND IN COMMERCE.

BY M. R. SCHINDLER.

THREE different kinds of copal are met with in commerce, but nothing is known of their distinguishing characteristics; for they all receive the general term—copal, and are all alike used in the preparation of varnish. There is, indeed, this distinction made, viz.: that they are called East Indian and West Indian copal; but under the latter designation two very different substances are comprised.

With respect to the East Indian copal, called also African copal, very little is known besides the locality in which it is produced. It is more colorless, transparent, and soft than the other species; forms a very fine surface; and, when heated, gives out an agreeable odour. As it is mostly found in a globular form, the name of globular copal has been given to it. This kind of copal furnishes the finest varnish. Old essence of turpentine acts very slightly upon it; newer essence dissolves it completely, but does not dissolve more than its own weight, without the excess of resin being precipitated. Essence rectified or digested upon sulphur will dissolve double its own weight, without precipitating the resin, but not more.

Essence of rosemary, when old and thick, only serves to swell this copal; when fresh, rectified, or raw, as found in commerce, provided it has been well kept, it will dissolve this resin in any proportion; and it furnishes a limpid yellowish solution, varying, of course, in density, according to the proportions of the substances. A solution made with two parts of essence of turpentine is very thick.

This kind of copal melts more easily than the two others; it is less volatile, and produces very little, if any, empyreumatic oil, but only acidulated water. If the operation be conducted without access of air, and the fire be moderated, and the vessels employed are such as to allow of the free disengagement of the liquids formed, the copal will be scarcely more colored after fusion than it was before. As soon as it has ceased to froth up, the fusion is complete, and good essence of turpentine will dissolve it in any proportion,—producing a fine varnish, applicable (according to the method by which it is dissolved) to metals, pictures, wood that is exposed to the air, leather, and furniture.

For a metal varnish or lacquer, digest 1 part of powdered copal in 2 parts of pure alcohol; this varnish, however, dries very quickly, and therefore the following is preferred:—1 part copal, 1 part essence of rosemary, and from 2 to 3 parts of pure alcohol, which will produce a solution as limpid as water. It is to be applied hot, and, when cold, will become very hard and durable.

For thermometrical scales, engravings, &c., the following ingredients are recommended:—1 part copal, 1 part essence of rosemary, and 3 parts essence of turpentine, recently rectified, or

digested upon sulphur. After moderate digestion, the solution will be perfect. This varnish dries very quickly, but is not so hard as the preceding, although it resists very well the action of the atmosphere.

The following composition is recommended for varnishing leather, especially for delicate colors:—6 parts of essence of turpentine, saturated with caoutchouc, mixed with a solution of 2 parts of copal, in 2 parts of essence of rosemary. This varnish must be applied in a fluid state, and dried at a high temperature.

For furniture, the most economical varnish is composed of melted copal, dissolved in essence of turpentine. If the copal has not been kept a sufficient length of time in a state of fusion, the varnish will remain soft for a considerable period after drying; and when dry it will crack.

The other species, called West Indian or American copal, which comes to us in small flat fragments, is very hard, rough in appearance, and without taste or smell. It is generally of a yellowish color, and is never colorless, like the former. Insects are very rarely found in it. It comes from the Antilles, Mexico, and North America. According to Lemery, it flows from a large tree in the Antilles into rivulets running down the mountains, and is thence carried into rivers, and deposited on their banks. According to this chemist, it owes its great hardness to being long immersed in the water. On attentively examining its exterior, it will be seen that the coating which envelops it, and which is rough and opaque, does not bear the marks of earth or sand. The inequalities which appear are mostly too insignificant to enable any definite form to be distinguished; they are, however, frequently found to be elevations with six faces, of nearly the same height, and depressions or cavities, having the aspect of network, as if the soft resin had been deposited on a tissue and left to dry. Impressions of leaves and branches are seldom met with. Wherever the impression of the texture is most apparent, the depressions are reticulated, and of equal depth. The exterior appearance of this copal does not, therefore, indicate subterranean origin. On account of its hardness, it has obtained in France the appellation of hard copal.

Pure alcohol dissolves this substance in such small quantity that there is no advantage in making varnishes with alcohol, although varnishes prepared by this means are very hard and durable;—rectified essence of turpentine slowly dissolves a very small quantity; and, on submitting it to continued heat, the solution acquires a color. By new essence of rosemary, it may be swollen, but cannot be dissolved. It is more difficult to melt than globular copal, and gives off less acid water, but a large quantity of empyreumatic oil. Melted, with access of air, it becomes completely black; only, for this purpose, choice must be made of a vessel in which the empyreumatic oil can be easily collected. As soon as the frothing ceases, the fusion is complete. If it has not been sufficiently prolonged, or if, for the purpose of

dissolving it, essence of turpentine, containing a great deal of resin, be employed, a great quantity of undissolved copal will be precipitated. Even when the greatest precautions are observed, it is difficult to prepare, with this copal, a varnish which does not possess a brownish color.

The third kind of copal, which is known also under the denomination of West India copal, appears to have been formerly sold as a product of the East Indies; and this, more especially, when only used for pharmaceutical purposes. It is found in fragments, of convexo-concave form, the outer covering of which appears to have been removed; and frequently contains pieces of bark, and more often insects;—so much so, that scarcely a piece of the size of a nut can be found which is quite free from them. This copal has an aromatic odour, which may be easily perceived when rubbed. It is by no means hard, and, on being heated, it easily takes the impression of the fingers: when cold, it can be readily broken. Its color is the same as that of hard copal; and to distinguish it from this latter, it is called insect copal. It is affected by essences of rosemary and turpentine, and alcohol, in the same way as hard copal. Its point of fusion is between the two others. On melting, it gives less acid and water than the first, but a large quantity of ethereal and empyreumatic oil. Otherwise, it melts in the same manner as the hard copal. By treating it with precaution, a transparent varnish may be produced; but it is so soft, and dries so slowly, that this last species appears of very little use in the manufacture of varnish.

RED COLOR FOR PAPER-HANGINGS, &c.

It is proposed to employ the red chloride of chrome for the production of an intense red violet color, possessing metallic lustre, proper for printing or staining paper.

This product is prepared, as is well known, by passing a current of dry chlorine gas over a mixture of powdered charcoal and calcined oxide of chrome, enclosed in a glass tube. Attention must be especially given in this operation to the fact that, by reason of the difficulty of volatilization of the product, the chloride prepared by a first operation remains mixed with the powdered charcoal. It is, therefore, requisite to submit this mixture of charcoal and chloride of chrome to a second operation, taking care to cover the bottom only of the glass tube with it,—in which case the product will be sublimed in the upper part of the tube. The heat of an argand lamp, the flame of which is brought gradually upon the tube, will suffice for the formation of the chloride, which soon appears in the form of brilliant micaceous peach-colored spangles. The chloride is then ground in a mortar, and thickened with a mucilage of gum. On being laid upon paper it will display its original color, and will resist the action not only of acids and alkalies, but also the direct action of the solar rays.

TRANSACTIONS OF THE SOCIETY OF ARTS.

FEBRUARY 13TH, 1850.

MR. GEORGE WALLIS *read a paper on the present condition of art as applied to calico printing.*

Mr. Wallis commenced by referring to the paper read by him to the society last session, in which he endeavoured to trace out the past progress and present condition of calico printing, so far as related to the mechanical and chemical departments; he then proceeded to give a general outline of the subject, and to call attention to a series of illustrative specimens, shewing the limits to which design is subject when applied to particular fabrics.

The mechanical means generally employed in printing calicoes are blocks and cylinders, and the colors are "madders" and "steams." Of the class of fabrics on which steams are usually employed, mousseline-de-laine was mentioned as a type; while the prints usually known as Hoyle's are distinct examples of madders. The madder dyes, properly executed, are essentially fast, and the tints are only to be reduced by repeated boilings and washings,—a course frequently taken by the printer to get his color down to the desired hue. The fast colors are the following: red, ranging in tint from dark crimson to light pink; purple, ranging from the darkest tint to the lightest shade; chocolate; brown; and black. Besides these madder colors, there is a fast blue, produced from indigo and catechu brown: thus, with the exception of yellow, and consequently green of a brilliant tint, the range of fast colors is complete. In steams there is a wider range of colors (including green, yellow, orange, &c.), with less permanence of tint; but in de-laines these may be considered as fast,—wool having a much greater affinity for coloring matter than cotton.

The author next proceeded to call attention to the nature of the designs suitable for madders, and first referred to mill-work, in which each roller is necessarily limited in size from two-and-a-half to four inches in circumference: this gives the size of the repeat of the pattern. The class of designs best suited to this process of manufacture is that of stripes, as they are easily engraved and readily printed: striped patterns should be varied not so much in form as in disposing the groups upon them.

The artistic effect of the details is only limited by the number of cylinders; but the author is of opinion that the most agreeable effects can be produced with two or three tints; as true artistic feeling is quite consonant with simplicity in materials.

Mr. Wallis next referred to the extent to which the effect of relief might be successfully carried. The best art is that in which the art is most concealed: on seeing a lady's dress, or a furniture print, the sentiment of the whole ought to strike us, without any portion being so obtrusive as to cause special enquiry as to what it is or how it is produced. Of the effects producible in madders, the monochrome is the most suitable. A flat relief is very

effective for half-mourning. All the various processes of engraving are applicable for the production of different effects: where the repeat is small, mill-work is used; and where it is large, the cylinder is engraved all over by hand, and a "cover" added by the etching process.

Steam colors constitute the great mass of productions in calico printing, particularly for the foreign trade. The range of these colors, capable of easy introduction, offers a great temptation to the designer to supply his want of artistic effect by showy vulgarity; and thus, while madders are usually confined to two or three cylinder machines, steams occupy as many as four, five, six, and in some instances seven cylinders.

The author then cautioned designers against crowding their patterns for the sake of introducing several colors; and he proved, by examples, that freedom of treatment is compatible with perfect accuracy of execution. He further urged the propriety of more closely studying nature, both for harmony of colors and for elegance of form: the former shewn so variously in the skins of animals, in shells, flowers, leaves, and insects; and the latter in the growth, interlacing stems, &c., of grasses and other vegetables—amongst which the ability of the artist in selection and combination will find a wide field for exercise.

Mr. Wallis next glanced at what he termed "de-laine" effects, including mousselines-de-laine, muslins, and barèges,—all of which he classed under the general head of calico printing. The best specimens are chiefly block-work, which affords a wider range of pattern and a larger number of colors than can be got in mill-work; but five may be said to be about the average. Attempts have been made to combine block with cylinder work, but the effect is rarely satisfactory; and, on account of the mechanical difficulty of the combination and the cost of production, it may now be said to be abandoned.

The author concluded his paper by calling attention to the various specimens and designs upon the walls, and to the new application of printed calicoes to panelling and internal decoration.

Specimens of a new black ink, capable of resisting the action of acids and alkalies, by Mr. Galbraith, were placed on the table and exhibited.

March 20th.

Exhibition of the Works of Ancient and Mediæval Art.

The Society having closed their rooms, to afford an opportunity for arranging the ancient and mediæval works of art sent in for exhibition, again opened their doors to the public on the above evening. This exhibition, which is, in its way, a very unique and choice affair, more especially so to the antiquary, is intended to shew the state of the decorative arts, between the thirteenth and seventeenth centuries, in relation to wood and ivory carving, em-

broidery, and working in metals; and thus to enable the modern artist and manufacturer to form a correct judgment of his own handiwork, as compared with those of ancient times, prior to the great display in 1851. With the policy of this proceeding we entirely concur; and, excepting those specimens which called for the exercise of genius as well as manipulation, we have full confidence that the productions of the workman of the present day will not be found unequal in quality at the forthcoming display of the works of emulative nations, as compared with those now exhibiting at the Society's rooms.

THE EXHIBITION OF 1851.

It is with no small satisfaction that we perceive a total change in the plans and conduct of the promoters of the proposed Industrial Exhibition of 1851, since the dissolution of the contract made with the Messrs. Munday, for providing the requisite funds for carrying out that truly national object. There is now an evidence not merely of a desire to meet the expressed wishes of the manufacturing community, but even to anticipate them if possible; and we think that nothing could more strongly demonstrate the interest with which the project is regarded by all classes of society than the success of the recent banquet at the Mansion House,—unless, indeed, it be the ample pecuniary contributions which are expected to flow into the coffers of the Commissioners from that happy suggestion of the Lord Mayor, in calling together his brother magistrates from all parts of the United Kingdom, and thereby drawing from them a pledge of personal co-operation in the carrying out of the Industrial Exhibition. By the appended statement, which has been issued by the Commissioners, it will be seen that their intention is to do nothing rashly; but that, although they have settled some essential preliminary matters of arrangement, &c., they are yet open to avail themselves of suggestions which may tend to the success of the undertaking. We shall, therefore, at a future opportunity, return to a consideration of the subject; and we hope that others, whose advice may be of service, will do their part in furthering the work, more especially as their communications can be readily made through the chairman or committee of their locality. The following is the statement referred to:—

Her Majesty's Commissioners for promoting the Exhibition of 1851, have had under their consideration the subject of the prizes to be awarded to exhibitors, and have resolved to take immediate steps for having medals struck of various sizes and different designs; it being their opinion that this is the form in

which it will, generally speaking, be most desirable that the rewards should be distributed. They will endeavour to secure the assistance of the most eminent artists of all countries in producing the medals, which will, they hope, be valuable as works of art of the highest class; besides serving as records of distinction in connexion with the exhibition. They have decided to select bronze for the material in which the medals are to be executed; considering that metal to be better calculated than any other for the developement of superior skill and ingenuity in the medallic art; and at the same time the most likely to constitute a lasting memorial of the exhibition. A notice, stating the conditions of competition, will be issued without delay.

With regard to the mode in which the prizes are to be awarded, the Commissioners think it inexpedient to establish beforehand rules so precise as to fetter the discretion of the juries upon which the task will ultimately devolve. It will be sufficient for the present to indicate the general principles to which it will probably be advisable to conform in the award of prizes for successful competition in the several departments of the exhibition.

In the department of raw materials and produce, for instance, prizes will be awarded upon a consideration of the value and importance of the article, and the superior excellence of the particular specimens exhibited; and in the case of prepared materials, coming under this head of the exhibition, the juries will take into account the novelty and importance of the prepared product, and the superior skill and ingenuity manifested in the process of preparation.

In the department of machinery the prizes will be given with reference to novelty in the invention, superiority in the execution, increased efficiency, or increased economy, in the use of the article exhibited. The importance, in a social or other point of view, of the purposes to which the article is to be applied will also be taken into consideration, as will also the amount of the difficulties overcome in bringing the invention to perfection.

In the department of manufactures, those articles will be rewarded which fulfil, in the highest degree, the conditions specified in the sectional list already published, viz.:—

Increased usefulness, such as permanency in dyes, improved forms and arrangements in articles of utility, &c. Superior quality, or superior skill in workmanship. New use of known materials. Use of new materials. New combinations of materials, as in metal and pottery. Beauty of design in form, or colour, or both, with reference to utility. Cheapness, relatively to excellence of production.

In the department of sculpture, models, and the plastic art, the rewards will have reference to the beauty and originality of the specimens exhibited, to improvements in the process of production, to the application of art to manufactures, and, in the case of models, to the interest attaching to the subject they represent.

These general indications are sufficient to show that it is the wish of the Commissioners, as far as possible, to reward all articles in any department of the exhibition which may appear to competent judges to possess any decided superiority, of whatever nature that superiority may be, in their own kind. In selecting the juries who are ultimately to guide them in making their award, the Commissioners will take the greatest pains to secure the services of men of known ability to form a judgment, above the suspicion of either national or individual partiality (for which purpose they will be composed partly of English and partly of foreigners), and who may be expected to recognize and appreciate merit wherever it may be found, and in whatever way it may show itself. The names of persons selected to act on these juries will be published when decided upon.

A question having been put to the Commissioners as to the parties who will be allowed to exhibit, and who will be entitled to prizes, they avail themselves of this opportunity to state that all persons, whether being the designers or inventors, the manufacturers or the proprietors of any articles, will be allowed to exhibit, and that it will not be essential that they should state the character in which they do so. In awarding the prizes, however, it will be for the juries to consider, in each individual case, how far the various elements of merit should be recognized, and to decide whether the prize should be handed to the exhibitor without previous enquiry as to the character in which he exhibits.

Lastly, the Commissioners have to state that, in announcing their intention of giving medal prizes, they do not propose altogether to exclude pecuniary grants, either as prizes to successful competition, or as awards, under special circumstances, accompanying and in addition to the honorary distinction of the medal. There may be cases in which, on account of the condition of the life of the successful competitor (as, for instance, in the case of workmen), the grant of a sum of money may be the most appropriate reward of superior excellence; and there may be other cases of a special and exceptional nature, in which, from a consideration of the expense incurred in the preparation or transmission of a particular article entitled to a prize, combined with a due regard to the condition and pecuniary circumstances of the party exhibiting, a special grant may, with propriety, be added to the honorary distinction. The Commissioners are not prepared, for the present at least, to establish any regulations on these heads. They consider it probable that a wide discretion must be left to the juries, to be hereafter appointed, in respect to the award of money prizes, or the grant of money in aid of honorary distinctions; it being understood that such discretion is to be exercised under the superintendence and control of the Commission.

Scientific Adjudication.

COURT OF COMMON PLEAS.

WESTMINSTER HALL.—*Monday, 25th February,* 1850.

Sittings in Banco, after Hilary Term.—Present, Mr. Justice MAULE; Mr. Justice CRESSWELL; Mr. Justice WILLIAMS; and Mr. Justice TALFOURD.

CROLL *v.* EDGE.

JUDGMENT.

MR. JUSTICE MAULE.—This was a motion for a new trial in an action on the case for the infringement of a patent, described in the declaration as a patent for making gas,—for improvements in making gas, and in the apparatus used in transmitting and measuring it. There are several pleas on the record: among others there is a plea stating that the specification, mentioned in the declaration, was of another and different invention from that for which the patent was granted. There is also a plea of *non concessit,* and other pleas. There was a verdict for the defendant at the trial before my Lord Chief Justice, and a rule *nisi* for a new trial was had and argued; and, in the argument upon it, the question turned upon the sufficiency of the specification,—regard being had to the plea that I have mentioned. It appeared that the patent was granted for the object, as appeared by the title of the patent mentioned in the declaration, and properly described in the declaration as a patent for making gas,—for an "improvement in making gas, and the apparatus used in transmitting and measuring it";—not saying, "used therein and in transmitting and measuring it," but "used in transmitting and measuring it." No specification was enrolled of any patent with that particular title; but a specification was enrolled reciting the patent with the title which I have adverted to, with the words that I have mentioned inserted or interpolated between the word "used" and the words "in transmitting;" so that the specification represented itself, in its introductory part (which I may call its title), as a specification of an improvement in the making of gas, and in the apparatus used therein and in transmitting and measuring it. The insertion is very slight, in point of the number of words and extent, but it wholly alters the meaning: that is to say, it adds most materially to the meaning and extent of the words in which it is interpolated, and extends substantially the grant of the crown; because, in lieu of the title, as suggested in the specification, it represents the patent as being a patent for two distinct things; or at least a patent for an apparatus used for the making of gas, and the other—which is well known to be a perfectly distinct thing—the transmitting and measuring it. The making of gas is a chemical operation well known,—the object of which is to evolve from coal or other material, by means of heat ordinarily,

the gas which is contained in it, or which is capable of being produced therefrom. That is the making of the gas:—then the apparatus used in it, and described in the specification, is no object of the grant. The other object—the other result mentioned in the title, is the transmitting and measuring it. Transmitting the gas, after it is made and stored up for use in a gasometer, is done by sending it through pipes, and through another instrument used in measuring it, called a "gas-meter": the more regular word used to denote the instrument for the purpose of measuring gas, viz., "gasometer," having been previously applied, before the invention of gas-meters, to the large reservoirs used for storing it. These two objects are evidently perfectly distinct from one another: the making of gas being one thing, and the measuring it, when produced by a manufacturer, in this or in any other way, being a totally different object. Now the patent granted was, for improvements in making gas, and the apparatus used, not in making, but in transmitting and measuring it. The title of the patent does not profess to comprehend any apparatus used in making gas. The patentee, in representing to the Crown that he had made such an invention, and in obtaining such a patent, did not give warning to the Crown by the ordinary modes, and, consequently, did not give notice to persons interested in such concerns, that he considered himself as having at all obtained any right to any exclusive use or manufacture of making any apparatus used in the making of gas. Now, the title of the patent, as mentioned in the specification, is, as I observed before, one which comprehends as well the apparatus and improvements in the making, as in the transmitting and measuring gas; and when the body of the specification is looked to, the main part of the matter, described in the specification as the invention of the patentee, is a mode of manufacturing which in all probability may have been and was, a new one, and an improvement. There is now a mode of manufacturing retorts and apparatus used in making gas, and used in transmitting and measuring it. The words are, "for the improvement of the apparatus used in transmitting and measuring it." For if any person on reading the specification, or the title, or on looking through the body of it, to ascertain more clearly what was intended to be claimed, and what was the patent which the patentee professed to have enrolled—any person would see, without the least doubt, that the main object of the claim of which he professed to be enrolling the specification,—that the main object of it was, an improvement in the apparatus used for manufacturing gas. It seems to us that it is difficult to suppose that the enrolling of this specification, in the terms in which it was enrolled, can be considered as otherwise than an attempt either to remedy what might possibly have been an oversight, or otherwise an attempt to alter and extend the patent that had been granted; and, in doing that, it seems to us that the patentee has omitted to specify the restricted patent which he had obtained, and has specified a

larger and different one, which he had not obtained. That is the view which we take of this specification,—that it is insufficient within the sixth plea. But if it were not insufficient within that plea, probably there are other pleas on the record, that of *non concessit*, very likely, under which this specification might be considered insufficient, in the alternative of its being sufficient under the sixth plea. We think, however, that it is insufficient under the sixth plea, and that the plaintiff has not enrolled the specification of a patent which was granted to him, but the specification of another, supposed, different, and hypothetical patent, or intended to refer to another patent. If another patent had been actually granted to him for improvements in making gas, and for the apparatus used therein and in transmitting and measuring it, no one could have doubted that this specification referred to that patent, supposing it to have been granted, and was not the specification of the patent at present in question. We think, therefore, upon the whole, that the direction of the Lord Chief Justice was substantially correct—that the defendant was entitled to the verdict, and therefore that this rule should be discharged. There is, I believe, power reserved to have a nonsuit entered if the plaintiff should elect.

Mr. Serjeant Channel.—The course taken at the trial was this, my Lord. The objection which your Lordship has pronounced judgment upon was strictly taken at the trial. The Lord Chief Justice had doubts whether the question arose upon the fourth, sixth, or seventh issue; and it was thought a convenient course not to be either party to either of them, but to bring before the Court the question, whether the objection was pleaded or not. No verdict was pronounced by the jury; but the Lord Chief Justice directed the jury on those issues, giving me leave to enter the verdict for the plaintiff, with forty shillings damages; and it was agreed that his Lordship should be taken to have directed the jury according to the view which the Court would take of the point, and then either party was to be at liberty to tender a bill of exceptions. I am now to understand that it is on the sixth issue that the Court considers the question to arise. I do not know whether I should apply to the Lord Chief Justice to carry out the rest of the arrangement?

Mr. Justice Maule.—I suppose you must apply to the Lord Chief Justice.

Mr. Serjeant Channel.—My learned friends must do me the justice to say that I have not asked for such an arrangement. It was thought a common course to take at the time, and the arrangement came from the Lord Chief Justice himself. His Lordship directed the jury, and said he would be taken to have directed the jury according to the view which the Court would take of the question of law; and the only difference between the plaintiff's and the defendant's situation was to be this, that if the defendant succeeded in his objection, the verdict was to stand, his Lordship's

direction being then correct; but if the judgment of the Court upon the point was to be in my favor, that is, for the plaintiff, then the verdict was not to stand, but there should be a *venire de novo*. If your Lordship will take a note of it, I will apply to the Lord Chief Justice, understanding the objection to be a good one, arising more distinctly on the sixth plea; but if not upon the others, the plaintiff is to have the benefit of it.

Mr. Justice Maule.—I do not see how that is to be done. The established course—a course established for a great number of centuries—is otherwise. I should think, myself, that the best way was to have a nonsuit entered; so that, if you thought fit to bring another question before the Court you might do so.

Mr. Serjeant Channel.—Perhaps, on this consideration, I should do so. There might be other points to be objected to. Perhaps your Lordship will stay the *postea* till next term, to have the opinion of the Lord Chief Justice.

Mr. Duncan.—I hope the Court will not allow the *postea* to to be delayed. A Bill in Chancery has been pending since 1845, and this is an issue directed by the Vice-Chancellor—an action I mean.

Mr. Serjeant Channel.—My brother Byles assented to the arrangement, and all I ask is, if possible, that it may be carried out, and if not, that the next best thing might be done.

Mr. Justice Maule.—Was there power left to enter a nonsuit?

Mr. Serjeant Channel.—No, my Lord. The learned Chief Justice said that the point was too important to be disposed of at *Nisi Prius*. A verdict was entered for the defendant on the fourth, sixth, and seventh issues; and the jury were discharged by consent on all the other issues. Leave at the same time was given to the plaintiff to move to enter a verdict on the fourth, sixth, and seventh issues, with damages forty shillings,—the Court to determine what direction on those issues the learned judge ought to have given,—the learned judge to be considered to have given that direction,—and either party to be at liberty to tender a bill of exceptions. Mr. Serjeant Byles suggested that, as it might turn out that his Lordship's direction was correct, and a Court of Error might afterwards hold it was not, and he had still a good defence on the merits, our verdict with forty shillings damages ought not to stand absolutely. Then, if a Court of Error should be of opinion with the plaintiff, we should be entitled to a *venire de novo*. Now I agree, if I may say so respectfully, that these agreements are not easily carried out; and all I ask is, that, with my brother Byles' consent, this may be carried out.

Mr. Justice Maule.—If the Court gave judgment for the plaintiff, then there was to be a *venire de novo?* We have the question here argued upon the motion for a new trial; so, what the plaintiff seeks at the utmost is a new trial.

Mr. Serjeant Channel.—The suggestion came from the bench. It was adopted in pursuance of his Lordship's view. It had

been suggested by the Lord Chief Baron of the Exchequer, and at that time had been acted upon in several cases. I am sure the Lord Chief Justice will be disposed to give us all the justice he can.

Mr. Justice Maule.—What are the three pleas? *Non concessit* is one.

Mr. Serjeant Channel.—They are the fourth, sixth, and seventh. The fourth is, that he, the plaintiff, did not particularly describe and ascertain the nature of the said invention; the sixth was, that the invention in the declaration mentioned was not the invention for which the letters patent were granted; and the seventh was, that, before the making of the letters patent, a petition had been presented to the Crown, representing the invention in a certain way, and that that representation was false and untrue, whereof the Crown had been deceived in making the grant. It was said that the objection might be raised on either of those pleas,—that a verdict for the defendant should be taken on them now,—and that the jury should be discharged with respect to the other issues. It was then arranged that if the defendant should fail in making out his objections, then that there should be a verdict for the plaintiff, with forty shillings damages. Then my brother Byles said, he could not let the verdict stand so absolutely; for he said he had a defence on the merits.

Mr. Justice Maule.—Was there a plea of no specification enrolled?

Mr. Serjeant Channel.—I do not think there was in those terms, my Lord. The fourth is, that the plaintiff and the co-patentee did not particularly describe and ascertain the nature of the invention.

Mr. Justice Cresswell.—Yes, that is it.

Mr. Justice Maule.—Then I think that on that plea, and, on the sixth, which states that the invention mentioned in the specification was not the invention for which the letters patent were granted, the verdict should be entered for the defendant. I think that is the opinion of the Court. What is the fourth plea?

Mr. Serjeant Channel.—That the plaintiff did not particularly describe and ascertain the nature of the said invention, and the mode in which the same was to be carried into effect.

Mr. Justice Maule.—The "said invention" was an invention for purposes mentioned in the specification, only omitting the words "therein and."

Mr. Serjeant Channel.—Yes, my Lord.

Mr. Justice Maule.—Then the verdict should be entered for the defendant on the fourth plea also. That plea is, that they did not specify the said invention. The sixth is, that the invention specified was different from the patent for which the letters patent were granted. That seems to be the same thing, pretty much; and the defendant may enter the verdict on both or either of these at his election.

Mr. Serjeant Channel.—Will your Lordship stay the *postea* till next term, to apply to the Lord Chief Justice.

Mr. Justice Maule.—I think that must be done. I think it is incident to this mode of proceeding.

Mr. Serjeant Channel.—Does your Lordship propose that the verdict on the seventh issue should be for us? I do not wish to tie the Court.

Mr. Justice Cresswell.—That is the misrepresentation. There is no evidence of a misrepresentation I think.

Mr. Serjeant Channel.—The verdict is for us, then, on that issue.

Mr. Duncan.—Mr. Serjeant Byles is not here my Lord, but I would submit that that issue ought not to be found for the plaintiff.

Mr. Justice Cresswell.—You must remember, Mr. Duncan, that you place yourself in difficulty by taking the verdict on many pleas; as there may be a bill of exceptions, and perhaps a *venire de novo*, if you take the verdict on too many of the issues. So I would advise you to be cautious about it.

Mr. Duncan.—I will, my Lord.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Feb. 27. *Jams Syson Nibbs*, of Baslow, Chesterfield, Derbyshire, for "the oxydate condensing lamp."

Mar. 1. *R. W. Winfield*, of Birmingham, for sacking for metallic bedsteads.

1. *Robert Harris*, of Bramston, Northamptonshire, farmer, for "the annular cultivator."

1. *Nathaniel Clissold Fluck*, of Gloucester, for an improved pattern cutting machine.

2. *Smiths & Co.*, of 1, Blair-street, Edinburgh, oil and lamp merchants, for "the economic wick elevator."

2. *James Firth*, of Belfast, locomotive superintendent, for a fire-bar for locomotive and other furnaces.

2. *James Moon*, of Malton, Yorkshire, for a chimney cap.

4. *John Sweet Willway*, of Denmark-street, Bristol, mathematical instrument maker, for "the Phero-pneuma, or gas carrier."

5. *Edwin John Vickery*, of 178, Great Dover-road, Borough, for a merino-bodied hat.

5. *James Thomas Woodman*, of Walton-on-Thames, for a portable self-adjusting leg and foot-rest.

5. *William George Barker*, of 18, Old Cavendish-street, Cavendish-square, for an elastic opening to be inserted in boots or shoes.

Mar. 5. *William Johnson*, of Farnworth, Lancashire, for a self-acting lubricator for spindles, or any similar object, when revolving at a great speed.

6. *The Rev. Anthony Singleton Atcheson*, Rector of Teigh, in the County of Rutland, for a portable writing, travelling, or invalid table.

7. *Samuel Sheppard*, of James-street, St. Paul's, Birmingham, cock founder, for an improved pump with draught and stop-cock.

7. *T. & C. Clark*, of Wolverhampton, for an improved coffee mill.

7. *Joseph Gardner*, of 39, Cross-street, Hill-street, Birmingham, agent to the Midland Railway Company, for "the invalid's supporter, or bed-rest."

11. *Samuel Sharp & Co.*, of Vauxhall, in the county of Surrey, for an implement for distributing and sowing seed, and for a strickle or tool for regulating the quantity of seed in the said implement.

11. *Deane, Dray, & Deane*, of King William-street, London Bridge, for an improved railway brake.

12. *Thomas Waddington*, of Derby-street, Cheetham Hill road, Manchester, for a self-adjusting clip for gaiters and leggings.

12. *Richard Harris & Sons*, of Leicester, for a polka.

12. *Thomas John Marshall*, of No. 80½, Bishopsgate-street Without, paper machine maker, for a dandy roller for letter and note paper.

13. *Thomas Hooke*, of New-cut, Lambeth, chair manufacturer, for a portable bed-room fire-escape.

14. *William Sellars*, of Sheffield, for a saw-back.

14. *Ritchie & Son*, of Cross-causeway, Edinburgh, for a printing and embossing machine.

14. *Daniel, William, & Thomas Bentley*, of Margate, Kent, ironmongers, for spiral spring compasses.

15. *J. & W. Vokins*, of 5, John-street, Oxford-street, for a revolving standard folio frame for prints, drawings, &c.

18. *Haldane & Rae*, of Edinburgh, brass-founders, for part of a tap for drawing-off liquids.

18. *Andrew Robertson*, of Crofthead, in the parish of Neilston, in the county of Renfrew, Scotland, for an apparatus for weighing, measuring, and registering.

19. *John Le Blanc*, of Huddersfield, for a chest expanding and equalizing apparatus.

20. *James Wood*, of Bridge-street, Portwood, Stockport, shuttle maker, for a shuttle weight and thread, or yarn presser.

21. *Alexander Vaughan & John Hossack*, of Canal-street, Castle Field, Manchester, engineers and millwrights,

for a self-acting lubricator, or oil cup, for shafts, spindles, or any similar objects revolving in a horizontal position.

Mar. 21. *Frederick Augustus Dietrich,* of Bennett-street, Blackfriars, for an elastic hat lining.

21. *Samuel Collier,* of 132, Castle-street, Reading, for an improved junction pipe, or hollow brick.

22. *James Lockhead, Frederick Sanders, & Charles Richardson,* of New Oxford-street, London, for a ship's scuttle.

22. *Spilsbury & Downes,* of Huggin-lane, Cheapside, for a fastening for articles of dress.

22. *Christopher Halliman,* of Kensington, gardener, for a fruit protector.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th February to the 17th March, 1850, inclusive.

To Joseph Stovel, of Suffolk-place, Pall Mall East, in the county of Middlesex, tailor, for improvements in coats; part of which improvements are applicable to sleeves of other garments.—Sealed 22nd February.

Lucien Vidie, of Paris, in France, but now of South-street, Finsbury, French Advocate, for improvements in conveyances on land and water.—Sealed 23rd February.

William Henry Phillips, of York-terrace, Camberwell New Road, in the county of Surrey, engineer, for improvements in extinguishing fire; in the preparation of materials to be used for that purpose; and improvements to assist in saving life and property.—Sealed 26th February.

James Higgins, of Salford, in the county of Lancaster, machine-maker, and Thomas Schofield Whitworth, of Salford, in the same county, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, and similar fibrous materials.—Sealed 26th February.

Auguste Reinhard, of Leicester-street, Leicester-square, in the county of Middlesex, chemist, for improvements in preparing oils for lubricating purposes, and in apparatus for filtering oil and other liquids.—Sealed 26th February.

Onesiphore Pecqueur, of Paris, in the Republic of France, civil engineer, for certain improvements in the manufacture of fishing nets and other net fabrics.—Sealed 27th February.

Ernest Gaston, of the Erectheum Club, St. James's, in the county of Middlesex, gentleman, for certain improvements in artificial fuel, and in machinery used for manufacturing the same.—Sealed 1st March.

Alexandre Hediard, of Paris, in the Republic of France, for certain improvements in propelling.—Sealed 5th March.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in manufacturing leather,—being a foreign communication.—Sealed 6th March.

Thomas Marsden, of Salford, in the county of Lancaster, machine maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances.—Sealed 8th March.

Henry Attwood, of Goodman's-fields, in the county of Middlesex, engineer, and John Renton, of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch and other like articles of commerce from farinaceous and leguminous substances.—Sealed 12th March.

James M'Donald, of the City of Chester, coach-maker, for certain improvements in the mode of applying oil or grease to wheels and axles, and to machinery; and in connecting the springs of wheel carriages with the axles or axle-boxes.—Sealed 15th March.

James Hill, of Stalybridge, in the county of Chester, cotton spinner, for improvements in or applicable to certain machines for preparing, spinning, and doubling cotton, wool, and other fibrous substances.—Sealed 16th March.

List of Patents

Granted for SCOTLAND, subsequent to February 22nd, 1850.

Auguste Reinhard, of Leicester-street, Leicester-square, London, chemist, for improvements in preparing oils for lubricating purposes, and in apparatus for filtering oil and other liquids. —Sealed 25th February.

Onesiphore Pecqueur, of Paris, civil engineer, for certain improvements in the manufacture of fishing nets and other net fabrics.—Sealed 25th February.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain ores and other matters containing metals, and in obtaining products therefrom.—Sealed 26th February.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for improvements in manufacturing leather,—being a communication.—Sealed 27th February.

Eugene Ablon, of Panton-street, Haymarket, London, for improvements in increasing the draft in chimneys of locomotive and other engines,—being a communication.—Sealed 4th March.

William Brown, of Airdrie, Lanarkshire, electrician, and William Williams, the younger, of St. Dennis, in the county of Cornwall, Gent., for improvements in electric and magnetic apparatus for indicating and communicating intelligence.—Sealed 4th March.

Alexandre Hediard, of Paris, for certain improvements in propelling.—Sealed 5th March.

Thomas Richards, William Taylor, and James Wylde, the younger, all of the Falcon Works, Walworth, Surrey, cotton manufacturers, for improved rollers to be used in the manufacture of silk, cotton, woollen, and other fabrics.—Sealed 6th March.

James Hill, of Stalybridge, county of Chester, cotton-spinner, for improvements in or applicable to certain machines for preparing, spinning, and doubling cotton, wool, and other fibrous substances.—Sealed 8th March.

John Fowler, jun., of Melksham, county of Wilts, engineer, for improvements in draining land.—Sealed 8th March.

Gerard John De Witte, of Brook-street, Westminster, for improvements in machinery, apparatus, metallic, and other substances, for the purposes of letter-press and other printing,—being a communication.—Sealed 8th March.

David Christie, of No. 3, St. John's-place, Broughton, in the borough of Salford, merchant, for improvements in machinery for preparing, assorting, straightening, tearing, teazing, doubling, twisting, braiding, and weaving cotton, wool, and other fibrous substances,—being a communication.—Sealed 13th March.

Edward Ormerod, of Manchester, mechanical engineer, and Joseph Shepherd, of Chorlton-upon-Medlock, engineer, for improvements in or applicable to apparatus for changing the position of carriages on railways.—Sealed 13th March.

Frank Clarke Hills, of Deptford, Kent, manufacturing chemist, for an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain salts. —Sealed 15th March.

William Handley, of Chiswell-street, Finsbury, London, confectioner, George Duncan, of Battersea, Surrey, engineer, and Alexander M'Glashan, of Long Acre, London, engineer, for improvements in the construction of railway brakes.—Sealed 20th March.

Warren De La Rue, of Bunhill-row, London, for improvements in the manufacture of envelopes.—Sealed 20th March.

James Higgins, of Salford, machine-maker, and Thomas Schofield Whitworth, of Salford, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials.—Sealed 22nd March.

New Patents
SEALED IN ENGLAND.
1850.

To Thomas Richards, William Taylor, and James Wylde, the younger, all of Falcon Works, Walworth, in the county of Surrey, cotton manufacturers, for improved rollers to be used in the manufacture of silk, cotton, woollen, and other fabrics. Sealed 2nd March—6 months for inrolment.

William Edwards Staite, of Throgmorton-street, in the City of London, Gent., for improvements in pipes for smoking; and in the apparatus connected therewith. Sealed 4th March—6 months for inrolment.

William Mc Naught, of Rochdale, in the county of Lancaster, engineer, for certain improvements in steam-engines; and also improvements in apparatus for ascertaining and registering the power of the same. Sealed 7th March—6 months for inrolment.

John Fowler, jun., of Melksham, in the county of Wilts, engineer, for improvements in draining land. Sealed 7th March—6 months for inrolment.

Gerard John De Witte, of Brook-street, Westminster, Gent., for improvements in machinery, apparatus, metallic and other substances, for the purposes of letter-press and other printing,—being a communication. Sealed 7th March—6 months for inrolment.

John Tebay, of Hackney, in the county of Middlesex, civil engineer, for an improved meter for registering the flow of water and other fluids. Sealed 7th March—6 months for inrolment.

Frederick Rosenborg, of Albemarle-street, in the county of Middlesex, Esq., and Conrad Montgomery, of the Army and Navy Club, St. James's-square, in the same county, Esq., for improvements in sawing, cutting, boring, and shaping wood. Sealed 7th March—6 months for inrolment.

William Benson Stones, of Golden-square, in the county of Middlesex, Manchester warehouseman, for improvements in treating peat and other carbonaceous and ligneous matters, so as to obtain products therefrom,—being a communication. Sealed 7th March—6 months for inrolment.

William Brown, of Airdrie, Lanarkshire, electrician, and William Williams, the younger, of St. Dennis, in the county of Cornwall, Gent., for improvements in electric and magnetic apparatus for indicating and communicating intelligence. Sealed 7th March—6 months for inrolment.

Henry James Tarling, of Bayswater, in the county of Middlesex, commission agent, for improvements in the manufacture of fuel and manure, and deodorizing and disinfecting materials. Sealed 7th March—6 months for inrolment.

Ebenezer G. Pomeroy, of Cincinnati, in the county of Hamilton, and State of Ohio, United States of America, chemist, for a new and useful process of coating iron and other metals with copper and other metallic substances. Sealed 7th March—6 months for inrolment.

William Church, of Birmingham, for certain improvements in machinery or apparatus to be employed in manufacturing cards and other articles composed wholly, or in part, of paper or pasteboard; part or parts of the said machinery being applicable to printing the same, and parts to other purposes where pressure is required. Sealed 7th March—6 months for inrolment.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson & Co., of Fleet-street, in the City of London, patent agents, for improvements in types, stereotype plates, and other figured surfaces for printing from,—being a communication. Sealed 7th March—6 months for inrolment.

Richard Carte, of Southampton-street, Strand, in the county of Middlesex, professor of music, for certain improvements in the musical instruments designated flutes, clarionets, hautboys, and bassoons. Sealed 7th March—6 months for inrolment.

John Tayler, of Manchester, in the county of Lancaster, mechanical designer, and Richard Hurst, of Rochdale, in the same county, cotton spinner, for certain improvements in and applicable to looms for weaving; and in machinery or apparatus for preparing, balling, and winding warps or yarns. Sealed 7th March—6 months for inrolment.

Thomas Irving Hill, of Clapham, in the county of Surrey, Gent., for certain improvements in the treatment of copper and other ores, and obtaining products therefrom. Sealed 9th March—6 months for inrolment.

Richard Holdsworth, of the firm of Holdsworth & Co., cotton spinners, and William Holgate, engineer, both of Burnley, in the county of Lancaster, for improvements in apparatus and machinery for warping worsted, cotton, and other fibrous materials. Sealed 11th March—6 months for inrolment.

William Crane Wilkins, of Long Acre, in the county of Middlesex, engineer, for certain improvements in ventilating, heating, and lighting; in lamps and candlesticks; in the manufacture of candles; and in the apparatus to be used for such purposes. Sealed 11th March—6 months for inrolment.

James Nasmyth, of Lille, in the Republic of France, engineer, for improvements in the method of obtaining and applying heat. Sealed 12th March—6 months for inrolment.

Robert Milligan, of Harden, near Bingley, in the county of York, manufacturer, for an improved mode of treating certain floated warp or weft, or both, for the purpose of producing ornamented fabrics. Sealed 18th March—6 months for inrolment.

George Jenkins, of Nassau-street, Soho, in the county of Middle-

sex, Gent., for certain improvements in the means of producing motive power. Sealed 18th March—6 months for inrolment.

Thomas Edmondson, of Salford, in the county of Lancaster, printer, for improvements in the manufacture of railway and other tickets; and in machinery or apparatus for marking railway and other tickets. Sealed 19th March—6 months for inrolment.

William Joseph Horsfall, and Thomas James, both of the Mersey Steel and Iron Works, Toxteth Park, Liverpool, in the county of Lancaster, for improvements in the rolling of iron and other metals. Sealed 19th March—6 months for inrolment.

Samuel Cunliffe Lister, of Manningham, near Bradford, in the county of York, and George Edmond Donisthorpe, of Leeds, in the same county, manufacturer, for improvements in preparing and combing wool and other fibrous materials. Sealed 20th March—6 months for inrolment.

William Joseph Curtis, of Port of Spain, in the Island of Trinidad, in the West Indies, civil engineer, for improved machinery and apparatus adapted for the manufacture of sugar. Sealed 23rd March—6 months for inrolment.

Horatio Carter, of Thirza-place, Old Kent road, in the county of Surrey, Gent., for certain improvements in the production of light from ordinary coal gas, by the use of burners, consisting of more than one ring or sheet of flame, combined with a suitable chimney or chimneys, and supplied with atmospheric air, particularly adapted to ventilation. Sealed 23rd March—6 months for inrolment.

Joshua Siddeley, jun., brass founder, of Liverpool, for certain improvements in ships' fittings. Sealed 23rd March—6 months for inrolment.

Alfred Wilson, of Myddleton-street, Clerkenwell, clock-case maker, for an improved ventilator. Sealed 23rd March—6 months for inrolment.

John Stephenson, of Roan Mills, Dungannon, in the county of Tyrone, flax spinner, for certain improvements in machinery for spinning flax and other substances. Sealed 23rd March—6 months for inrolment.

William Sykes, of York-street, in the county of Middlesex, tallow chandler, for certain improvements in the manufacture of candles and wicks. Sealed 23rd March—6 months for inrolment.

John Varley and Joseph Hacking, of Bury, in the county of Lancaster, engineers, for certain improvements in steam-engines and apparatus connected therewith. Sealed 23rd March—6 months for inrolment.

Henry Robert Ramsbotham, of Bradford, in the county of York, manufacturer, and William Brown, of the same place, mechanic, for improvements in preparing and combing wool. Sealed 23rd March—6 months for inrolment.

John Gedge, of Wellington-street, Strand, in the county of Middlesex, for an improvement in lamps and candlesticks,—being a communication. Sealed 23rd March—6 months for inrolment.

Nathaniel Mathew, of Wern Tremadoe, in the county of Carnarvon, quarry proprietor, for an apparatus for cutting or dressing slates into various shapes and sizes. Sealed 23rd March—2 months for inrolment.

Alfred Guillaume Roseleur, of Paris, in the Republic of France, but now of 4, South-street, Finsbury, in the county of Middlesex, chemist, for certain improvements in coating or covering metals with tin. Sealed 23rd March—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor-handles, inkstands, door-knobs, and other articles where hardness, strength, and durability are required,—being a communication. Sealed 23rd March—6 months for inrolment.

Edward Welch, of St. John's Wood, London, architect, for improvements in fire-places and flues, and in apparatus connected therewith. Sealed 23rd March—6 months for inrolment.

Evan Leigh, of Miles Platting, near Manchester, in the county of Lancaster, cotton-spinner, for his invention of certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances. Sealed 26th March—6 months for inrolment.

Joseph Theodore Clenchard, of Paris, in the Republic of France, manufacturing chemist, for certain improvements in the application of archil to the processes of dyeing and printing in colors, and also an improved apparatus to be employed in the operation of dyeing. Sealed 26th March—6 months for inrolment.

James Preece, of the city of Hereford, shoemaker, for certain improvements in mills and machinery applicable to the thrashing and grinding of corn, the manufacture of cider, and other similar purposes. Sealed 26th March—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in coupling-joints for pipes,—being a communication. Sealed 26th March—6 months for inrolment.

Thomas Dickason Rotch, of Drumlamford House, in the county of Ayr, North Britain, Esquire, for improvements in separating various matters usually found combined in certain saccharine, saline, and ligneous substances,—being a communication. Sealed 26th March—6 months for inrolment.

CELESTIAL PHENOMENA FOR APRIL, 1850.

D.	H.	M.	
1			Clock before the ☉ 3m. 59s.
	—		☽ rises 11h. 43m. A.
	—		☽ passes mer. 3h. 27m. M.
	—		☽ sets 8h. 8m. M.
	—		Occul. 29 Ophiuchi, im. 13h. 41m. em. 14h. 52m.
	9	22	♃'s second sat. will em.
	9	28	♃'s first sat. will em.
	18	23	☿ greatest hel. lat. S.
	18	58	♂ in conj. with ε Geminorum, diff. of dec. 0. 8. S.
4	3	44	☽ in □ or last quarter
	16		☽ in Apogee
5			Clock before the ☉ 2m. 47s.
	—		☽ rises 2h. 18m. M.
	—		☽ passes mer. 6h. 40m. M.
	—		☽ sets 11h. 3m. M.
	—		Occul. π Capricorni, im. 15h. 21m em. 16h. 36m.
6	9	10	Vesta in □ with the ☉
	12		♀ in conj. with ♅ diff. of dec. 0. 22. N.
8	0	7	Juno in oppo. to the ☉, intens. of light 0·432
	11	23	♃'s first sat. will em.
	11	58	♃'s second sat. will em.
9	12	0	♂ greatest hel. lat. N.
10			Clock before the ☉ 1m. 22s.
	—		☽ rises 4h. 52m. M.
	—		☽ passes mer. 10h. 32m. M.
	—		☽ sets 4h. 22m. A.
10	1	9	☿ in conj. with ♄ diff. of dec. 0. 39. N.
11	5	31	♄ in conj. with the ☽ diff. of dec. 1. 47. N.
	10	12	♃'s fourth sat. will im.
	13	30	♃'s fourth sat. will em.
	9	56	☿ in conj. with the ☽ diff. of dec. 2. 45. N.
12	0	47	Ecliptic conj. or ● new moon
	4	48	♅ in conj. with the ☽ diff. of dec. 4. 15. N.
	17	41	♀ in conj. with the ☽ diff. of dec. 4. 21. N.
15			Mercury R. A. 1h. 24m. dec. 7. 48. N.
	—		Venus R. A. 2h. 15m. dec. 13. 0. N.
	—		Mars R. A. 7h. 2m. dec. 24. 41. N.
	—		Vesta R. A. 7h. 24m. dec. 25. 48. N.
	—		Juno R. A. 13h. 15m. dec. 1. 55. N.
15	—		Pallas R. A. 21h. 33m. dec. 7. 53. N.
	—		Ceres R. A. 23h. 14m. dec. 13. 46. S.
	—		Jupiter R. A. 11h. 3m. dec. 7. 38. N.
	—		Saturn R. A. 0h. 50m. dec. 2. 58. N.
	—		Georg. R. A. 1h. 38m. dec. 9. 37. N.
	—		Mercury passes mer. 23h. 54m.
	—		Venus passes mer. 0h. 42m.
	—		Mars passes mer. 5h. 29m.
	—		Jupiter passes mer. 9h. 28m.
	—		Saturn passes mer. 23h. 13m.
	—		Georg. passes mer. 0h. 5m.
	—		Clock after the ☉ 0m. 3s.
	—		☽ rises 7h. 7m. M.
	—		☽ passes mer. 2h. 42m. A.
	—		☽ sets 10h. 28m. A.
15			Occul. a Tauri, im 8h. 3m. em. 8h 59m.
	13	18	♃'s first sat. will em.
	14	36	♃'s second sat. will em.
16			Occul. 119 Tauri, im. 6h. 58m. em. 7h. 27m.
	—		Occul. 120 Tauri, im. 7h. 26m. em. 8h. 13m.
	4		♅ in conj. with the ☉
	21	4	☿ in conj. with ♅ diff. of dec. 0. 8. S.
17	12	13	☿ in sup. conj. with the ☉
18			☽ in Perigee
18	0	44	♂ in conj. with the ☽ diff. of dec. 4. 55. N.
19	10	7	☽ in □ or first quarter.
20			Clock after the ☉ 1m. 7s.
	—		☽ rises 11h. 51m. M.
	—		☽ passes mer. 7h. 30m. A.
	—		☽ sets 2h. 19m. M.
	18	1	☿ in the ascending node.
22	2	17	♃ in conj. with the ☽ diff. of dec. 0. 31. S.
24	9	40	♃'s first sat. will em.
25			Clock after the ☉ 2m. 7s.
	—		☽ rises 6h. 3m. A.
	—		☽ passes mer. 11h. 42m. A.
	—		☽ sets 4h. 15m. M.
25	7	37	☿ in Perihelion.
26	11	20	Ecliptic oppo. or ○ full moon
29	20	8	♀ in the ascending node
30			Clock after the ☉ 2m. 55s.
	—		☽ rises 11h. 26m. A.
	—		☽ passes mer. 2h. 56m. M.
	—		☽ sets 7h. 18m. M.

J. LEWTHWAITE, Rotherhithe.

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No. CCXXI.

RECENT PATENTS.

To Joseph Béranger, *of the firm of Béranger & Co., of Lyons, in the Republic of France, civil engineer, for improvements in weighing-machines.*—[Sealed 19th March, 1849.]

This invention relates, firstly, to certain new arrangements of weighing-machines upon the steelyard principle; secondly, to certain arrangements of compound balances for shop-counters and warehouses; and, thirdly, to arrangements of machinery for ascertaining the weight of locomotive engines and wheeled carriages.

In Plate X., the improvements which refer to the steelyard principle are shewn under several modifications; all of which (for the purpose of rendering the system upon which they are constructed the more obvious) are proportioned to weigh upon the decimal system of weights; but they are equally applicable to the English or other modes of division. Fig. 1, shews an arrangement of steelyard levers, suitable for ordinary use in shops. From a standard *a*, a bar *b*, is suspended by hooks entering eyes formed in that bar. Pendent from the bar *b*, are links *c*, c^1, in the lower ends of which a steel ring or eye (acting as a pallet) is set, to receive respectively the V-edged fulcra of the vibrating levers *d*, and *e*. The lever *d*, which is supported by the links *c*, carries at its long end the small scale *f*, which is intended to contain the weight; and at its weighted end, by means of a peculiarly-formed link *g*, a large scale *h*, is suspended. This link, which is shewn detached, in side and edge views, at figs. 2, is provided, at

top and bottom, with steel pallets 1, 1, which are retained in their places by stop-pins 2, 2;—these pallets are intended to receive V or knife-edges 3, projecting respectively from the upper side of the lever *d*, and from the lower side of the lever *e*; the link therefore, in addition to supporting the scale *h*, bears the weight of the lever *e*, on its lower pallet. The hook of the scale *f*, hangs upon a V-edge, formed in the up-turned end of the lever *d*; and it is weighted, to form an equipoise to the weight sustained by the short end of the lever *d*. Adjacent to the up-turned end of the lever *d*, is a bracket-piece *i*, which carries a pointer; and in a line there-with is another pointer projecting from the bar *b*: these are for the purpose of ascertaining the correctness of adjustment of the steelyard. Between the bracket-piece *i*, and the end of the lever *d*, a screw is supported horizontally; and upon the screw is a traversing nut, which, on being moved backwards or forwards, will determine the adjustment of the balance to the greatest nicety. *k*, is a link, provided with steel rings or eyes, and hanging upon a V-edged piece, projecting through the lever *e*. To this link, as also to the link *g*, a hook is attached (or the hook is made in one piece with the link) to receive the scale *h*, when it is required to weigh a more ponderous body than the weights in the scale *f*, are calculated to balance, while that body is suspended from the link *g*. It being remembered that the steelyard is constructed to weigh according to the decimal system—the proportion of the distance between the bearing points of the levers will be readily understood. From the fulcrum of the lever *d*, to the link *g*, is one-tenth of the long arm of that lever; and from the fulcrum of the lever *e*, to the knife-edge of the pin on which the link is suspended, is one-tenth of the whole distance of the fulcrum of *e*, to the point where that lever rests upon the lower pallet of the link: one pound, therefore, thrown into the scale *f*, would balance 10 pounds in the scale *h*, when suspended from the link *g*, and 100 pounds when the scale is pendent from the link *k*,—the scale *f*, having first, before the weighing commenced, been properly weighted to balance the scale *h*, in whichever of its two positions it is suspended.

Fig. 3, shews the improved arrangement of combined levers or steelyard applied to weighing a heavy solid body. This steelyard is supposed to be suspended from a strong beam; and, as in this figure, the same letters of reference are used as in fig. 1, and the several parts are precisely similar as regards their principle of construction, a further description

thereof will be unnecessary. When weighing a heavy body, such as a bale of goods, it is suspended from the link of the second or multiplying lever *e*, as shewn; and the counterpoise weight is placed in the scale *f*, or suspended from the end of the lever *d*. If, therefore, a 10 lbs. weight, placed in the scale *f*, is found to sustain in equilibrium the bale suspended from the hook of the link *k*, (the apparatus being proportioned, as before stated, to weigh decimal parts), the weight of that block will be 1000 lbs. When a small article is required to be weighed in this apparatus, the article is placed in the scale *f*, and the counterpoise weight is hung on the link *g*. In this instance one-tenth of the weight, which holds the article in equilibrium, will be the ascertained weight of the article.

The patentee next shews a slightly modified arrangement of the combined levers or steelyard intended to be used in large workshops for weighing articles of any weight, up to 20 or even 40 tons weight.—In this arrangement (which may be used in connection with a crane or otherwise) the lever *d*, is made to extend the whole length of its longer limb beyond the sustaining bar *b*, for the purpose of removing the counterpoise weight as far as possible out of the way of the workman when moving about the heavy substance to be weighed. To each of these arrangements a plumb-bob is applied, as at *l*, for determining the true horizontal position of the apparatus.

Figs. 4, 5, and 6, represent an arrangement of mechanism constructed on the steelyard principle, but applicable as a compact balance for a shop counter. Fig. 4, is a vertical elevation of the apparatus,—the side of the box which encloses the same being removed; fig. 5, is a plan view, with the scales or plates removed; and fig. 6, is a diagram, shewing the geometrical system upon which the balance is constructed. A bearing-piece *a*, attached to the bottom of the box, is provided at its upper end with pallets, to receive the knife or V-edges *b*, of a pair of vibrating levers *c*, *c*; which edges form the fulcrum of their motion. At their shorter ends these levers are attached together by a connecting-piece *d*; and at their other ends they are severally provided with a pin, to receive the hooks for attaching the extremities of a V-shaped bar *e*, thereto. *f*, is a lever, one end of which carries an arched or bent spring, with an adjusting-screw, while the other end is formed like a fork. The prongs of this fork carry two knife-edges *g*, *h*; the former of which is embraced by a link, pendent from a cross bar of the levers *c*, and the latter serves to

sustain a link which supports the inner end of the bar *e*. The outer or spring-end of the lever *f*, is connected by a link to a fixed bracket *i*, attached to the bottom of the box. *k*, is a standard, provided at its upper end with pallets suitable to receive the knife-edges of a vibrating-frame *l*; one end of which is connected by a link to a cross-bar of the levers *c, c*; and the other is weighted. This frame *l*, is intended to provide a V-support for the scale *m*, (which receives the article to be weighed) and, together with the V-bearings of the bar *n*, in the levers *c, c*, to sustain the scale in a parallel position during its up and down movements. For this purpose a link *o*, carrying at its lower end a V-edge, is pendent from the frame *l*; and upon it, and on the ends of the bar *n*, the feet of the scale rest. The V-shaped bar *e*, is, in like manner, sustained in a horizontal position; and from its face stand up two vertical pins, which carry the scale *p*, for receiving the counterpoise weights. Now, supposing this apparatus to be required to weigh according to the decimal system,—the length of the lever-frame *c*, (see fig. 6), from its fulcrum 1, to the bearing point 2, (where the connection is made with the frame *e*,) must be as ten,—the distance from 1, to 3, being as one. A pound weight, therefore, placed in the scale *p*, will equipoise an article of 10 lbs. placed in the scale *m*, and so on in proportion. To obtain the parallel motion for the scale, which is of great moment in exact weighing (ordinary balances being capable of giving different results according to the position in which the weight, or the article to be weighed, is placed in the scale) the proportions will be as follows:—For the scale *m*, from 1, to 3, of the lever frame *c*, will equal the distance from the fulcrum 4, of the frame *l*, to the point 5,—while the length from 4, to 6, equals from 7, to 1. For the scale *p*, the bearing points 8, 9, 10, of the lever *f*, will bear the same relative proportions of distance from each other that there is between the points 1, 11, and 2, of the lever-frame *c*.

Another application of the steelyard principle is shewn at fig. 7. This instrument is a platform weighing-machine, capable of being moved from one place to another. The weight of the load on the platform is conveyed to the steelyard by a peculiar arrangement of rocking-frames, enclosed in a box forming the base of the weighing-machine; and, by means of a graduated rotating wheel and vernier, the amount of weight may be read off with facility. These levers are shewn in plan view at fig. 8, in side view at fig. 9, and in end view at fig. 10. A, is a rocking-frame, provided with a V-edged bar *a*, which rocks on pallets formed on the blocks *b, b*; and B, is a similar

frame, which rocks on the blocks *b**, *b**. Near the middle of the box enclosing these levers is a link (similar to that before described with reference to figs. 2,), for connecting the two levers together, and causing them to move simultaneously when a weight is laid on the platform. *c, c,* are four bearing-points, for the platform C, which, with its bearing-pieces, is shewn in edge view at fig. 11. These bearing-points may be formed of V-edges, let into the rocking-frames; but where great sensitiveness is required, the shackle-piece D, (shewn as applied to the frame A, and, on an enlarged scale detached, at figs. 12,) is preferred. This piece D, carries a pair of pallets *d*, which are loosely supported, and bear upon the V-edges of the bar A; and from the ends of the shackle-piece project the V-edges on which the platform rests. A*, is a bar, forming a continuation of the rocking-frame A;—it passes under the cross bar of the rocking-frame B, and is intended to transmit the pressure of the loaded platform to the steelyard. The bar A*, is provided with a knife-edge (as shewn at fig. 9,), which rests upon a rocking-bar E. This bar E, is supported at one end by a V-knife-edge (with which it is furnished) resting upon a pallet on the bearing *e*; and its other end is supported by a link at the lower end of a vertical rod F, connected with the steelyard apparatus. G, G, are supports, for sustaining this apparatus, which is shewn detached, and on an enlarged scale, at fig. 13. It consists of a graduated bar *f*, cranked at each end, to form the bearings for a screw *g*, the pitch of which is made to correspond to the graduations of the bar *f*. *h*, is a traversing link, suspended from the bar *f*, and carrying the weight *i*. Through this link the screw *g*, passes (the link being suitably threaded for that purpose); and, as the screw is capable of turning freely in its bearings, it will, when rotated, cause the link to traverse along the bar *f*, and, with the weight, take up any required position. On the outer edge of the screw *g*, a wheel *k*, graduated on its periphery, is fixed; and a handle, projecting from the face of this wheel, serves to rotate the screw. This wheel is graduated into hundreds, tens, and single pounds; and the subdivisions of the pound are obtained by the use of a vernier. From the end of the bar *f*, near to the wheel *k*, stands up an arm *l*, which, on one side, carries the vernier for reading off from the graduated wheel *k*, the weight of the load on the platform; and the other side of the arm *l*, has a pointer, for determining, with a corresponding pointer affixed to the supporting frame G, the proper adjustment of the weighing apparatus. The bar *f*, with its screw and graduated wheel and

vernier, rocks upon a V-edge *m*, which rests upon a pallet at the top of the main standard of the supports G; and a link *n*, resting upon a V-edge on the weighted end of the bar *f*, connects the rod F, and, consequently, the platform apparatus, with the indicating apparatus. It will thus be understood that, when a load is placed on the platform C, and the rocking-frames A, and B, are thereby depressed, the pressure will be communicated through the bar A*, and rod F, to the shorter end of the bar *f*; the screw *g*, is then rotated until the weight *i*, is brought into the proper position for counterpoising the load; the number of divisions between the fulcrum of the bar *f*, and the link *h*, are then read off on the wheel *k*, (indicating English pounds, if the bar is suitably graduated); and the subdivisions of these graduations are read off from the vernier. It is obvious that, if, instead of using the weight *i*, which is supposed to represent any given number of pounds English, a weight equal to a received French, Spanish, or other foreign weight, be substituted, the result will be obtained in French, Spanish, or other measure, instead of in English pounds.

A modification of the arrangement of index weighing-machine, just described, is shewn at figs. 14, and 15, as applicable to a shop-counter. A, B, are the rocking-frames, for supporting the weighing-table: they are mounted on V-edges, and linked together as before explained. Attached to the rocking-frame B, and vibrating therewith, is a frame C, which forms the bearings for a screw *g*, similar in construction to that in the above-described arrangement. It is rotated by means of its vernier wheel *k*, and traverses a counterpoise-weight *i*, which is provided with a pointer, for indicating, on a line of divisions over which it moves, the weight of the load placed on the weighing-table. The vernier *k*, as in the former instance, shews the subdivisions of any one of these divisions, whether they indicate pounds or any other given weight. At fig. 16, the vernier for reading off the weight of a load is shewn applied to a steelyard beam. The face of the beam (for decimal weighing) is divided into hundreds, and subdivided into fifties, tens, and twos. A length equal to nine divisions of the beam is divided into ten on the vernier. The vernier is attached to the link which traverses the beam and carries the counterpoise weight; and a portion of the side of the link is cut away, as shewn, to leave a pointer to indicate, on the divisions of the beam, the number of pounds the load weighs: the decimal parts of the pound are read off from the vernier in the usual way.

The second head of the invention relates to compound balances, suitable for shop-counters, and is intended to effect greater sensitiveness in the movements of the balance, and more certainty as to the result of the weighing operation. In all the balances described under this head, there is a compensating motion, which will preserve the scales in a perfectly horizontal position, and will admit of the parts for sustaining the scales being so arranged that, whether the weights or the goods to be weighed are placed in the middle or at the side of the scales, an exactly similar result will be obtained—which cannot be insured in scales of the ordinary construction. Fig. 17, represents a longitudinal section of one of the improved shop-counter weighing-machines, with an indicator for shewing the proper adjustment of the parts; and fig. 18, is a plan view of the same. It consists of a pair of balance-levers A, A, which are connected together with a central V-edged bar *a*; this bar rests on steel pallets, set in the standard B, and allows of the free vibration of the levers A: the ends of these levers are forked, to receive respectively the ends of four hooks *b*, *b*;—a V-edged pin being set in the prongs of the forks to sustain these hooks. *c*, *c*, are cross-bars, connecting the levers A, A, together (see fig. 18,), and provided at the middle of their length with V-edges, on which hang the links *d*, *d*; these links are each intended to sustain a compensating lever C, which carries at one end a bent or arched spring with a regulating screw, similar to that before described with reference to fig. 4; and these spring-ends are respectively attached by a link to the bracket pieces *e*, *e*, which are bolted to the bottom of the box enclosing the weighing apparatus. The other or inner ends of the levers C, are forked like the levers A, and similarly provided with V-edged pins, from which hang the links *f*, *f*. D, D, are floating frames, each having three points of suspension; one by the links *f*, which embrace an inverted V-edged pin, with which their inner ends are provided; and the other points of suspension are by the hooks *b*, before mentioned, which are fixed to the outer ends of the frames D, and hang from the ends of the balance levers. Projecting from each of the frames D, are four vertical pins *g*, *g*, which pass through the cover of the box, and form rests or supports for the scales *h*, *h*, fig. 1. At *i*, *i*, the wires, which are continued upwards to form the indicator, are attached to the frames D, and their upper ends are provided with arrows, which, when they stand at a horizontal line (the machine not being in use) shew that it is nicely adjusted for accurate weighing. The

arrows are to be enclosed in an ornamental bracket-piece, having a glass face on both sides, through which the arrows can be seen. The action of this weighing apparatus will be readily understood. One end of the balance-levers A, being depressed, and the other consequently rising, a similar motion will be given to the frames D; except that the movement being given direct from the balance-levers to the outer ends of the frames D, and through the compensating lever C, to their inner ends, a perfectly horizontal position will be maintained by these frames, as they rise or fall; and consequently the scales which they support will retain a similar position. It is obvious that no gain or loss in the result of the weighing operation will be effected from the weight, when placed beyond the centre of the scale, acting upon it as a lever, and thereby unduly affecting the beam, as is at present the case with weighing machines generally; because, the compensating lever C, having the same value at *f*, as the lever A, has at *b*, the strain will be equal at all parts of the scale. This construction of balance, which, for the sake of distinction, the patentee terms the "dial-face balance," may be variously modified, without affecting the principle of its construction: for instance, a central balance-lever, with branching ends, may be employed instead of the two levers A; and a bridle-piece, attached to the floating-frame D, and terminating upwards in a vertical rod, may be made to carry a cup to receive the scale, instead of four supports being affixed to the frame D. The position of the central balance-lever may also be changed without involving any alteration in the compensating principle upon which the construction of this balance is founded. This will be readily understood on referring to the diagrams in Nos. 1, 2, and 3:—No. 1, shews the balance-lever above the compensating apparatus; No. 2, shews it below; and No. 3, shews it in the midst thereof, that is, between the frames D, which are above, and the levers C, which are below. As respects the proportions upon which these balances are constructed, it is only essential that the points of motion and fixity on either side of the fulcrum of the balance-lever shall exactly correspond.

An arrangement of weighing apparatus, suitable for shop-counters, and of a more simple construction than that just described, is shewn at figs. 19, and 20;—fig. 19, being a plan view, and fig. 20, a longitudinal elevation, partly in section. It consists of a rigid rectangular balance-frame A, A, provided with a V-edged fulcrum bar *a*, which rocks on steel pallets, set in the central standard B, affixed to the base-plate C. To this base-plate C, are also affixed standards D, D, pro-

vided with steel pallets, to receive respectively the V-edged fulcrum-pins of rocking levers E, E^1. The ends of these levers E, E^1, are slotted, to receive a link *b*, (as shewn best at the right-hand end of fig. 20,); and a V-edge is formed on each end of the levers to carry the links. One end of these levers is attached to the rectangular frame A, and the other to one of the circular frames F, F^1, which carry the scales or dishes. Attached to the ends of the rectangular frame A, are loop pieces *c*, which are slotted (the edge of the slot being V-shaped); and an adjusting screw is provided, as shewn at fig. 20. The links *b*, suspended on the outer ends of the levers E, E^1, pass through the slots in the pieces *c*, and thus connect the levers E, E^1, and the balance-frame A, together. To the frames F, F^1, three feet are respectively attached: they are all forked at their lower ends; and the edge at the root of the prongs is V-shaped. These feet rest respectively, two on V-edges at the ends of the frame A, and the third in the link *b*, at the inner end of the levers E, E^1,—the lever E, being connected to the frame F^1, and the lever E^1, to the frame F. Thus, by means of the two levers E, E^1, a compensation movement is provided, which will preserve the scale-frames F, F^1, in a perfectly horizontal position. The proportions to be observed in making this kind of weighing-machine are, that the bearing points at the extremities of the levers E, E^1, shall be equidistant from their respective fulcra, and that the two levers shall exactly correspond.

The third head of the invention relates, as before stated, to improved machinery for weighing locomotive engines and wheel-carriages. Fig. 21, represents, in partial plan view, an arrangement of machinery for weighing six-wheel locomotive engines,—the weight sustained by each wheel being given separately, for the purpose of ascertaining the poise of the engine, as well as its total weight. Fig. 22, is a vertical section of the machinery. This machinery is a modification of the platform-levers described with reference to figs. 8, 9, and 10; each lever (of which there are six in this instance) having a separate and independent motion, and being connected to its respective steelyard or weighing apparatus. A, A^1, are eight chairs, bolted to blocks of stone, and set in two lines at equal distances apart. These chairs are provided with steel pallets *a*, to receive respectively the V-edges at the ends of the cross-bars of the rocking lever-frames B, B^1. These frames, on their upper face, are furnished with knife-edges at *b*, on each of which a peculiarly-formed link *c*, is suspended. The construction of this link will be understood

on reference to figs. 23, which represent it detached, and on an enlarged scale, in front view and in cross section. The link *c*, is connected by a shackle *d*, to a cross-piece *e*, with round ends, which take into rounded recesses in the lower end of a bracket-piece C:—the object of this construction will be presently understood, In the upper end of the link is a loose steel pallet, to receive the knife-edge of the lever-frame B. The back of this pallet is rounded, for the purpose of adjusting itself to the pressure it is to receive. The links *c*, are intended to carry the weight of the platforms or tables D; in order to sustain which, and throw their weight upon the links, sets of four bracket-pieces C, are secured together by rods *f*, and bars *g*, *g*, and made to form a framing, suitable for receiving the platform. Thus, over the four links *c*, which hang upon the four knife-edges at *b*, of the pair of rocking-frames B, B^1, a set of four bracket-pieces C, rigidly connected together, are placed; and, as soon as pressure is put upon the platform, they will communicate it to the links *c*, which will depress the pair of levers and cause them respectively to act upon their steelyard apparatus and indicate the amount of the load on the platform. As the bracket-pieces C, merely rest upon the cross-pieces *e*, of the link *c*, they may be readily removed when required, without disarranging the rest of the machinery. A bar, forming an extension of each one of the six rocking-frames B, B^1, is brought into connection with a vertical rod E, pendent from its particular steelyard apparatus, by means of links, as shewn at fig. 22; and thus, when a six-wheel locomotive is brought over the platforms (one pair of wheels resting on each platform), each rocking-frame will be depressed to a degree corresponding to the weight borne by the wheel above it; and, by the connection of these rocking-frames with their respective steelyards, the weight borne by each wheel will be separately indicated.

The patentee also shews a modification of the above weighing-machine, adapted for weighing four-wheel carriages. In this arrangement there are two rocking-frames B, B^1, each of which has three points of support, as before. They are provided with knife-edges, which rest on chairs A; and they carry links *c*, *c*, for sustaining the platform D, by means of the bracket-pieces C. The third point of support is upon pallet-links, which hang upon a knife-edge, set in a lever, which has its fulcrum on a chair, suitably supported by masonry. This lever is intended to transmit the weight of the load on the platform D, to the steelyard apparatus; and, for this purpose, it is attached to a vertical rod E, which is pendent from that

apparatus. Connected to this weighing-machine is an arrangement for temporarily fixing the position of the platform while being loaded, and thus preventing the machinery from being injured by the sudden jerks it would receive if the weight of the carriage were suddenly thrown upon it. It consists of a horizontal rod, mounted in suitable bearings, and extending across the machine immediately under the platform and under the steelyard apparatus. This rod carries two cams, which work between bridle-pieces, attached to the under side of the platform. To that end of the rod nearest the steelyard apparatus a lever is affixed; and, when this lever is drawn forward, the horizontal rod will move on its axis and bring an increasing diameter of the cams into contact with the bridle-pieces, and hold them firm by friction of contact. When the load is fairly on the platform, the lever is gradually returned to its first position; the cams then release their bite upon the bridle-pieces; and the platform is thus allowed to descend, and, by acting upon the apparatus below, cause the steelyard to indicate the weight of the load.

A further modification of this improved construction of machinery for weighing two-wheel carriages, is shewn in the drawings attached to the specification. It is very similar to that last described; two rocking-frames being mounted on chairs, and provided with links, on which the bracket-pieces that carry the platform rest. The movements of the frames are rendered simultaneous by their being connected together by a link, through which a bar, affixed to and forming part with one of the frames, passes. This bar is suitably provided with a knife-edge, on which the link rests; and it transmits the weight of the load to a vertical rod, pendent from the steelyard apparatus, as described with reference to the two preceding arrangements. It will be obvious that the improved compound levers may be used in connection with these weighing-machines; or steelyards of the common construction may be employed if thought desirable; but the apparatus which the patentee prefers to use in connection with the platform machines, is shewn in elevation at fig. 24, and in plan view at fig. 25. By means of this apparatus he is enabled not only to ascertain the weight of the load, but also to mark down that weight upon paper; by which arrangement five or six carriages per minute may be easily weighed. It consists of a vibrating frame *a*, *a*, which has its fulcrum at *b*; and at its upper end are bearings, to receive two rollers *c*, *d*, over which an endless band of paper is placed. On the axle of the roller *d*, a ratchet-wheel *e*, is fixed; and a click *f*, on the frame *a*,

taking into the wheel *e*, prevents the roller *d*, from rotating in more than one direction. This frame *a*, is placed in front of the steelyard apparatus, so that a horizontal pointer, affixed to the traversing link which carries the counterpoise weight along the beam of the steelyard, will be able to prick a mark upon the paper on the roller *c*, when the frame *a*, moves inwards. Mounted loosely on the axle of the roller *d*, is a bent arm *g*, which carries, at its upper end, a click *h*, in gear with the wheel *e*, and is slotted at its lower end, to receive a pin from a rod *i*, attached to the steelyard apparatus. This arrangement is intended to move forward the paper by rotating the roller *d*,—the impulse being given by the backward movement of the frame *a*. On the lower part of the frame *a*, a cross-bar *k*, (shewn in partial front view at fig. 26, and in plan at fig. 27,) is fixed. The face of this bar, at its middle, is slightly recessed, and against it the lever 8, works. This lever is connected with the apparatus before described, for temporarily fixing the platform; and, when the lever is in the position shewn at figs. 26, and 27, the platform will be fixed. A balance-weight *l*, attached to the frame *a*, gives that frame an inclination to approach the pointer of the steelyard. When, therefore, the lever 8, is moved to the position shewn by dotted lines, the frame will be enabled to advance a distance equal to the depth of the recess in the bar *k*, and thereby come in contact with the pointer. At the same time the platform of the weighing-machine will be released, and the weight of the load it contains will be transmitted to the steelyard. The link carrying the counterpoise weight is now traversed along the steelyard bar to take up a position where it will counterpoise the weight of the load on the platform. If, then, the paper on the rollers *c*, *d*, is ruled to correspond to the divisions of the steelyard, the mark of the pointer on the paper shewing, as it does, the position of the weight on the beam, will also indicate the weight upon the paper.

The patentee claims, First,—the general arrangements and combinations of parts forming the steelyard weighing-machines, as shewn at figs. 1, and 3; and particularly the application to the ordinary steelyard beam of the multiplying lever *d*. Secondly,—the use of a screw, or other analogous mechanical contrivance, for traversing the counterpoise weight upon the steelyard beam, when combined with a rotating graduated wheel for indicating the weight of the suspended load. Thirdly,—the application to steelyards of a fixed vernier, for reading off from a rotating graduated wheel the weight of the suspended load; and also the use of a sliding vernier,

attached to the link of suspension of the counterpoise weight, for indicating fractions of the graduations on the steelyard beam. Fourthly,—the arrangement of rocking-frames or levers for receiving from a platform the weight of a load and transmitting the same to the steelyard. Fifthly,—the combination of the compensating apparatus with the steelyard beam, as described with reference to figs. 4, 5, and 6. Sixthly,—the direct application to a steelyard beam of the arrangement of levers for supporting a table or platform, as shewn at figs. 14, and 15, whether such steelyard be provided with a vernier and traversing screw, as shewn, or have simply the ordinary graduated beam.

Under the second head of his invention the patentee claims the general arrangement and construction of the compound balances, as shewn at figs. 17, 18, 19, and 20; and particularly the use of the compensation levers for transferring to the balance-lever or balance-frame the weight of the load and counterpoise contained in the scales, and for maintaining the horizontal position of the scales, as before described.

Under the third head of the invention he claims, First,—the several arrangements of apparatus, shewn and described, for receiving and transmitting the weight of a loaded platform, or the separate weights of two, three, or more loaded platforms, to suitable weighing apparatus, for the purpose of ascertaining the weight of a load in the gross, or in divided parts, as above described. And, Lastly,—the application to steelyards of the arrangement of mechanism shewn at figs. 24, 25, 26, and 27, for marking down the weight of loads as they are weighed.—[*Inrolled September*, 1849.]

To Alfred Vincent Newton, *of the Office for Patents*, 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in manufacturing and refining sugar,—being a communication.*—[Sealed 23rd August, 1849.]

This invention relates to an improved method of separating the crystallizable saccharine principle from the juice of the sugar-cane or beet-root, or from other vegetable juices; whereby a larger quantity of sugar may be obtained than by the methods at present employed; the sugar being also of a superior quality.

The objects of the invention are effected by treating the saccharine fluid with a certain chemical agent or agents,

whereby the disposition to chemical change or fermentation, inherent in all vegetable juices, is effectually checked; or by precipitating and separating the crystallizable sugar from the fluid in which it exists as an insoluble compound, by adding to the fluid certain chemical substances which possess the property of combining with sugar to produce the effect just mentioned.

The patentee describes the invention under three separate heads, viz., the treatment of the juice as it flows from the cane; the precipitation of the saccharine particles; and, lastly, a mode of effecting the defecation of the juice.

With reference to the first part of the invention he remarks, that a source of great loss in the extraction of sugar from the juice of the cane or beet-root originates in the tendency of the expressed juice, when exposed to the atmosphere, to pass into a state of chemical change or fermentation, which is carried on at the expense of the saccharine principle contained in the fluid;—the elements of the saccharine matter assuming another form, and being accordingly lost to the manufacturer. In proportion as fermentation goes on, the quantity of crystallizable sugar is diminished; it is, therefore, an important object, under the old method, to expedite the different operations, even at great inconvenience, in order to prevent that loss of saccharine matter which would ensue if the expressed juice were kept for any length of time before being boiled down. With every precaution, however, a very considerable loss always occurs, both in consequence of the change which takes place to a greater or less extent in the juice, and from the quantity of sugar left in the solid residual matters, and wasted in washings of apparatus, &c.; and which can only be extracted when means are employed to prevent the chemical alteration which would be sure to take place when these vegetable products are kept in contact with a large quantity of water.

The first part of the present invention relates to the employment of a class of antiseptic substances, hereafter specified, which possess the property of preventing the accession of that chemical change or fermentation so destructive to the saccharine matter contained in the vegetable juice. The second part of the invention refers to the separation of the crystallizable sugar by its precipitation, as an insoluble compound, with any of the different agents hereafter described as capable of effecting that object: this process may either be employed alone or in combination with the first part of the invention. This part also relates to the preparation of the

precipitating agents, and to their regeneration, after having been employed in precipitating the sugar. The third part relates to the employment of certain chemical agents, together with, or as substitutes for lime, as defecators or purifiers of sugar.

Part I. *Treatment of cane-juice, juice of the beet-root, &c., by antiseptic agents.*—In order that the saccharine solution may be prevented from passing into a state of fermentation, the following plan of treatment is adopted:—The moment the cane is cut into pieces the separated portions or slices are plunged into a solution of sulphurous acid, of an acid sulphite, or of any other antiseptic substance,—no matter whether it be in a state of solution or merely mixed with water. The bisulphite of lime, employed at the moment in which the vegetable cells are laid open to the influence of the air, prevents the action of oxygen upon the azotized matters present in the sap;—these are, consequently, preserved from passing into a state of fermentation. The presence of the base or neutral salt does not permit of the transformation of the sulphurous acid into free sulphuric acid, which would act injuriously upon the sugar. The sulphuric acid, which is formed, passes to a portion of the lime,—converting that base into sulphate, a substance which is not only innocuous but which seems to play a useful part in the process. The bisulphite of lime entirely prevents any chemical change from taking place in the crystallizable sugar originally present in the sap of the cane, and permits of the extraction of the whole quantity of that sugar in the crystallized form, by rapid or slow evaporation, either in the air or in vacuo.

In order that this process may succeed completely, it is necessary that the antiseptic agent be intimately mixed with the cane-juice as soon as the cells containing it are broken down, either by crushing, rasping, or slicing. By thus operating, the juice will be preserved in its normal state; it will neither undergo chemical change nor acquire color; there will be no fermentation arising from decomposition or modification of the substances contained in the juice; the azotized compounds will remain unaltered; and the formation of ammoniacal salts will be effectually prevented. If the bisulphite of lime be employed only as a preservative agent, a very weak solution of that salt in water is used. The solution of bisulphite may be added to the cane-juice, by applying it over the cylinders of the crushing-mill, over those of the rasping-machine, or to the portions of cane as they fall from the slicing-machine.

The liquid expressed from the sliced cane, or flowing from the crushing-mill, may be submitted to evaporation in the same manner as any saline solution which is unalterable in the air. The solution is heated up to 100° Centigrade for some minutes, and then left to settle, so that the more limpid portion may be drawn off from the precipitate; it is then passed through bag-filters, to perfectly separate the solid matters held in suspension; and the filtered liquor is next evaporated. The evaporation may be conducted without the application of heat (that is to say), by exposure of a large surface of the fluid to the action of the air; the spontaneous evaporation being assisted by any of the means at present employed for that purpose. The fluid may, however, be concentrated by evaporation in pans, heated by a water-bath, or by steam, until it reaches a density, while hot, of about 25° Beaumé; it must then be filtered a second time, and afterwards brought up to the degree of concentration which will permit of the rapid crystallization of the sugar; or, if it be preferred, the crystallization may be carried on more slowly. The sugar will be found, in this operation, to be free from the coloring matter usually formed during evaporation; and fermentation will be entirely prevented, if the bisulphite of lime be added in such proportion that a small quantity of that compound remains in the fluid unchanged up to the termination of the process. Thus, by the employment of bisulphite of lime and simple filtrations, to separate the matters held in suspension, the whole of the crystallizable sugar may be separated by one process from the expressed juice. The use of the bisulphite of lime, or of the acid bisulphites in general, may be made available, both when the sugar is obtained from the cane by simple mechanical means only, and when a further process is resorted to, for the extraction of that portion of saccharine matter which is left in the cane-refuse after the action of the mill; that is to say, when the solid cane-refuse is subjected to repeated washings, for the purpose of obtaining the last portions of saccharine matter, which mechanical pressure alone could not remove: in that case, by the use of the bisulphite, the whole of the crystallizable sugar can be obtained (no matter how large the quantity of water employed) without loss from fermentation. All the acid sulphites may be employed as above; and neutral salts are also capable of producing similar effects, provided they be soluble in sulphurous acid, and provided also that the acid, set at liberty, can exercise no destructive action upon the sugar in the solution: thus the neutral phosphate of lime, dissolved in sulphurous

acid, may be used for the complete extraction of the crystallizable sugar,—the phosphate of lime being obtained from bones in their natural state, from calcined bones, or from bone-charcoal, which may be used in the same liquid.

Mustard—creosote—horseradish—nitrous acid gas, either alone or in combination with salts of iron or other salts;—tannin—lamp-black, saturated with creosote—the products of the distillation of certain bituminous matters, tars, or wood—essence of turpentine—aldehyde and analogous bodies—chlorine, either in the gaseous state or in solution, or in combination with oxygen—may all be employed as antiseptics in the extraction of sugar from the saccharine fluid, as in the process in which the bisulphite of lime is employed alone. The operation ought to be conducted in such a manner that, to the mother liquors, more or less rich in crystallizable sugar, may be added the saccharine liquors from the scum arising in the process of defecation, the drainings of filters, washings of apparatus, molasses, &c. This method of working, by which all the waste matters containing sugar may be turned to profit, is impracticable under the old plan, but may be used advantageously when the bisulphite of lime, or other antiseptic agent, is employed.

Part II. *Separation of the crystallizable sugar from saccharine fluids, in combination with baryta, strontia, lime, or other metallic oxides.*—1st. The hydrate of baryta, added in proper quantity to molasses, produces the following result:—The baryta enters into combination with the sugar, forming an insoluble saccharate of baryta, which, when washed with water, may be regarded as a pure substance, uncontaminated by admixture with any foreign matter. 2nd. In like manner, where baryta is applied to the expressed juice of the sugar-cane or beet-root, previously defecated by means of lime, the saccharine principle will be separated in an insoluble form, in combination with the baryta, and as much as 97 per cent. of the whole quantity of crystallizable sugar present in the fluid may thus be isolated; 3 per cent. only remaining in solution, combined with a further portion of baryta. 3rd. The saccharate of baryta, produced as above, when treated by any acid which forms an insoluble salt with baryta, such as carbonic acid, sulphurous acid, or sulphuric acid, furnishes crystallizable sugar in the state of solution, perfectly pure, and capable of producing refined sugar without any further preparation. 4th. Cane-juice or molasses, diluted with water, and treated in the cold state with an excess of lime, forms, with the latter, a soluble saccharate, the composition of which appears to vary

according to the density of the saccharine fluid at the time of mixing it with the lime: by boiling, the soluble saccharate of lime is converted wholly or in part into an insoluble saccharate, which is, however, only stable whilst the fluid remains hot. 5th. The oxide of strontium and the protoxide of lead also precipitate crystallizable sugar from its solution. The first of these requires, however, to be employed in great excess; and the second must be kept in contact with the saccharine matter during a very considerable time; and even, after all, effects the separation of the sugar but imperfectly.

Separation of crystallizable sugar by baryta.—In applying this process to the juice of the cane, the latter must be first subjected to a defecation with lime, without regard to whether it has been previously treated either with lime or with the acid sulphite of lime. The juice thus depurated is transferred while hot to a boiler, similar to that in which the defecation was carried on. Baryta, previously brought to the state of hydrate, is now added to the saccharine liquid, in the proportion of 50 or 60 parts of caustic baryta to every 100 parts of crystallizable sugar contained in the fluid: the mixture is strongly agitated, to promote the solution of the baryta; it is then brought up to the boiling point, when a precipitate of saccharate of baryta begins to be formed; and after a few minutes of ebullition, the reaction between the sugar and baryta will be complete. The liquid is now left at rest, in order that the precipitate may subside; the mother liquor, containing the excess of baryta in solution, may then be drawn off, and the precipitate completely separated from the fluid, either by the press, by the apparatus of displacement, or, better still, by the centrifugal apparatus at present in use for the defecation of sugar: the washed and prepared saccharate contains, according to the degree of pressure to which it has been subjected, about 50 per cent. of sugar, 22 per cent. of baryta, and 28 per cent. of water. By treating the saccharate of baryta with water, acidulated with sulphuric acid, the baryta separates in the form of the insoluble sulphate, and the sugar is set at liberty in the fluid as a syrup, more or less concentrated: 25 quarts of water and 28 lbs. of sulphuric acid (66° Beaumé) give a mixture of the most convenient strength for the decomposition of the saccharate of baryta, constituted as described above. In adding the diluted acid to the saccharate, a small quantity only must be poured in at a time, to prevent the presence of free sulphuric acid, which would act injuriously on the sugar; the addition of the acid must also take place in the cold;—it is therefore desirable that the dilute acid be

added in small consecutive portions to the whole of the saccharate;—the mass being stirred to favor the chemical action of the acid upon the baryta. When all the saccharate of baryta is believed to be decomposed, a slight excess of sulphuric acid may be added, so as to completely ensure the decomposition of the whole of the saccharate; the mixture may then be pressed without loss of time, to separate the syrup from the insoluble baryta compound; as the mixture ought never to be left for any length of time when free acid is present: if circumstances prevent the immediate treatment of the mixture for the separation of the syrup, it ought to be left with an alkaline reaction.

The acid syrup separated by the press from the sulphate of baryta must be neutralized by the addition of a little more of the saccharate; and by treating the fluid with a little sulphate of lime, the ultimate removal of whatever excess of baryta may be present will be effected. The precipitate of sulphate of baryta may be subjected to repeated washing and pressing, to remove the whole of the syrup; and it may conveniently be deprived of every portion of saccharine matter by the means described for cleansing the saccharate itself.

By following the above-described process, a syrup may be obtained of a density of 15° to 20° Beaumé, and which may be at once submitted to the ordinary process of refining,—furnishing a sugar of great purity, proper for commercial purposes.

To apply this process conveniently to the molasses of commerce, it will be necessary to bring the fluid, in the first instance, to a density of 20° or 25° Beaumé. If the liquid be prepared from molasses which contains uncrystallizable sugar, a quantity of lime is first boiled with the liquid, in the proportion of one part of lime to four parts of the uncrystallizable sugar found to exist in the solution. After boiling with the lime, the treatment with baryta, according to the description already given, is put into operation; the baryta added to the solution being in the proportion of 50 or 60 parts to every 100 parts of crystallizable sugar. The baryta used for this purpose should be in the state of hydrate, mixed and boiled with water; and the saccharine fluid should also be boiled and well stirred after the addition of the baryta, to promote the formation of the saccharate. The separation of the mother liquor from the precipitate may be effected in the manner already described: the mother liquor and the washings will serve economically to dilute a further quantity of molasses, so

as to bring it to the degree of density most proper for the action of baryta upon the saccharine principle.

In the process just now described, the caustic baryta or its hydrate may be substituted by sulphuret of barium—a compound of which the formation precedes that of the caustic baryta in the reproduction of the latter substance from the sulphate. When the sulphuret of barium is employed, copper vessels ought not to be used: the different operations should be performed in vessels of wood, or in those of zinc or cast-iron; neither of which metals are sensibly attacked by the sulphur.

In that part of the process which relates to the decomposition of the saccharate of baryta by sulphuric acid, a modification of the process may be employed. Instead of using sulphuric acid, an equivalent quantity of sulphate of lime may be added to the saccharate;—the result would be the formation, by double decomposition, of an insoluble sulphate of baryta, and a saccharate of lime extremely soluble in the cold: by employing a slight excess of sulphate of lime, the complete decomposition of the saccharate of baryta will be ensured. The saccharate of lime, held in solution, may be decomposed by sulphuric acid, sulphurous acid, or carbonic acid—either of which will separate the lime in an insoluble form; and a saccharine solution will be thus obtained sufficiently pure to furnish refined sugar of first-rate quality. If carbonic acid be used to remove the lime, this gas may be obtained by any of the ordinary means; by the combustion of carbon, for instance; by the calcination of limestone in a close chamber; by the decomposition of alkaline carbonates; and more especially by the action of hydrochloric or sulphuric acid upon chalk.

The saccharate of baryta, suspended in water, may be decomposed by passing through the fluid a current of sulphurous acid gas: the baryta is then separated in the state of insoluble sulphite. The sulphurous acid employed in this operation may be obtained by the combustion of sulphur or of a sulphuret, or by roasting the precipitate of sulphur and hyposulphite of baryta, obtained by treating with sulphurous acid the mother liquor from the precipitate formed when sulphuret of barium is added to the saccharine solution.

Separation of crystallizable sugar in combination with lime.—The cane-juice employed in this process must be first defecated with lime; then cooled down to 50° Centigrade; and then again treated by lime, in the proportion of 25 parts of the hydrate of lime to every 100 parts of crystallizable sugar

contained in the fluid: thus, a fluid containing 22 lbs. of sugar will require about 6 lbs. of hydrate of lime. The mixture is then heated to ebullition; and the saccharate of lime, which is insoluble at the boiling point of water, is separated by filtration. The saccharate of lime obtained by this first separation contains (if the operation has been well conducted) about 58 per cent. of the sugar which was present in the liquid. The saccharate consists of five equivalents of base to one of saccharic acid. The mother liquor obtained in this operation is cooled artificially, or permitted to cool spontaneously; it is then again treated with lime, in the proportion of from 3 to 4 lbs. to every 25 gallons of fluid; the mixture is boiled to precipitate the saccharate, which becomes insoluble at 100°; and the separation is effected by the means just now described. When cane-juice is thus treated, it will be necessary to repeat the operation at least four times: generally, it may be said that the treatment ought to be repeated more or less frequently, according to the density of the saccharine fluid, and to the degree of exhaustion which is desired to be produced without concentrating the fluid.

The different portions of saccharate produced in the above process are mixed together in water, and treated with any acid which, like carbonic acid or sulphurous acid, will form with the lime an insoluble compound; the saccharine matter is thus separated from the lime in the form of syrup, ready at once to furnish, by the usual treatment, refined sugar, fit for commercial purposes.

Separation of the crystallizable sugar by strontia.—What was said in describing the process of separating the sugar by means of baryta, is applicable in every respect to the employment of strontia. The latter is, however, inferior to baryta; firstly, on account of the large quantity required to produce an equal effect; and, secondly, from the circumstance of the saccharate of strontia being soluble in pure water.

Separation of crystallizable sugar by oxide of lead.—When oxide of lead is employed for this purpose, it requires to be kept for a considerable time in contact with the juice, in order to produce the precipitation of the sugar. What has been already said of the decomposition of saccharate of baryta by carbonic acid, applies equally to the oxide of lead. To complete this explanation, it ought perhaps to be added that the various processes above described, in reference to cane-juice, can be employed with equal success in separating the crystallizable saccharine principle from any other vegetable sap. It should further be stated that the new methods which con-

stitute the present invention may be employed either alone, combined with each other, or with any of the old methods of working. Thus, the sugar refiner may apply these processes to raw sugar, to molasses, or to syrups, in any stage of the manufacture: he may employ the old plan for the first workings of his sugar, and apply the new process only for the syrups in the second and third workings, or only to the molasses. The planter may, after having exhausted the canes by the ordinary process, obtain a still further quantity of saccharine matter from the cane refuse, by washings with hot or cold water: these defecated washings may be deprived of the whole of their sugar by the precipitating agents employed in the new processes; or they may serve to dilute the molasses which is intended to be subjected to treatment by baryta. Sugars obtained by the ordinary means, containing much color, may be easily separated from their molasses by the methods of Howard or Schatzenbach; and, after being cleared and decolorized, their molasses may be advantageously subjected to the treatment with baryta.

Production and restoration or reproduction of the baryta employed in the manufacture of sugar by the new process.— Any one of the known processes may be employed in the production or regeneration of the hydrate of baryta; as the basis of the operations, the sulphate of baryta is, however, preferred, as that is a substance found abundantly in nature, and obtainable at a very low price; but the carbonate or sulphite of baryta may, perhaps, be employed with equal advantage.

Whatever may be the process employed, the first step consists in procuring the baryta in the required state; the saccharate of baryta will then be formed by the action of the baryta on the cane-juice or molasses; and this saccharate is decomposed by passing a current of carbonic acid into the fluid holding the saccharate in suspension. The carbonate of baryta may be decomposed at a high temperature in an earthen retort or reverberatory furnace, under the influence of a current of super-heated steam; or the carbonate may be mixed with 15 or 20 per cent. of coal, and heated either with or without the introduction of steam; or the carbonate may be decomposed by means of nitric acid, and the liberated carbonic acid gas may then be employed to decompose a fresh portion of the saccharate of baryta.

The following is the mode of operating when sulphate of baryta is used:—The sulphate of baryta in powder, as it is found in commerce, is mixed intimately with 45 per cent. of its weight of ground coal, and the mixture is calcined at a high temperature

in a reverberatory furnace. When the sulphuration or rather deoxidation is complete, the charge is withdrawn from the furnace, and suffered to cool without exposure to air,—the mixture is afterwards dissolved in water, in which it is very soluble. The insoluble residue, if there be any, will consist of undecomposed sulphate of baryta: this may be added to a further quantity of sulphate, and submitted to the action of the furnace as before. If the sulphite of baryta be employed as the source of sulphuret of barium, it must be treated precisely in the same manner as the sulphate, in a reverberatory furnace: the result of the operation is the same, viz.,—the production of sulphuret of barium; but, in the case of the sulphite, less carbon is necessary to effect the reduction than when the sulphate is employed. The solution of sulphuret of barium, prepared as above, may be applied at once in the treatment of a solution of sugar, according to the process described in a former part of this specification.

To produce caustic baryta from the sulphuret of barium, in addition to the process by which the sulphuret is converted into nitrate, there are two other methods which may be preferred. Among metallic oxides the hydrated protoxides of zinc and of iron produce this transformation; but the oxide of copper is preferable, both as respects economy and its effect on the compound of baryta. The oxide of copper, added in equivalent quantity to the sulphuret of barium, passes into the state of insoluble sulphuret of copper, depriving the barium of the sulphur previously combined with it, and leaving it in solution as caustic baryta: this solution may be employed at once for the precipitation of the sugar; or the baryta may be separated from the solution by crystallization as hydrate of baryta. The sulphuret of copper, produced in this operation, is reduced again to the state of oxide, by being roasted in a reverberatory furnace; and the sulphurous acid generated may be advantageously employed when the acid sulphites are used in the separation of the saccharine matters. The solution of the sulphuret of barium, when concentrated to the proper point, gives rise to an abundant crystallization. The crystalline mass, which consists of sulphuret of barium, is next exposed to the influence of the atmosphere (free from carbonic acid); the sulphuret becomes oxidized and converted into half an equivalent of baryta and half an equivalent of hyposulphite of baryta: the latter is insoluble, and is separated by washings with hot water.

Part III. *The cleansing or purification of the saccharine juice, by the employment of certain defecating compounds.*—

The bisulphite of lime and the bisulphites or acid sulphites in general may be employed as a means of defecating or purifying the juice of the cane or other vegetable juices containing saccharine matter—permitting, consequently, of the extraction of the sugar without the intervention of any other agents. The defecating operation may be performed in the following manner:—The liquid expressed from the cane is first submitted to certain mechanical operations, for the purpose of removing solid impurities. A solution of bisulphite of lime, equal to 10° Beaumé, is then added, in the proportion of 1 per cent. of the original weight of the cane: an excess of this solution, however, does not produce any injurious effect; and the quantity may be increased to 10 per cent. of the weight of the cane, without causing any loss of sugar or other mishap.

After the treatment by the bisulphite of lime, if heat be applied to the solution, a portion of the bisulphite is converted into the neutral sulphite, which precipitates, coagulating and carrying down with it the albuminous matters contained in the solution. The mixture must now be allowed to remain at rest, in order that the solid matter may subside; the liquid is then drawn off and completely separated from every portion of the precipitate by filtration. The fluid may now be concentrated by evaporation, exactly in the manner and with the precautions described in the first part of this specification; and the saccharine principle may be obtained from the fluid by crystallization. The whole of this treatment closely resembles that employed when the bisulphites or acid sulphites are used only as a means of preventing fermentation in the saccharine fluid, and which has already been described in detail.

All the acid sulphites or bisulphites may be employed in the defecation of the cane-juice or other saccharine fluid; as may also those neutral salts which are soluble in sulphurous acid, provided the displaced acid cannot react injuriously on the crystallizable sugar.

By means of these processes the whole of the sugar contained in the cane-juice may be obtained in a state of purity; and, by the employment of the precipitating agents, described above, the sugar held back by the liquors may be entirely separated. This gives great value to that part of the invention which relates to the preservation of saccharine fluids from undergoing fermentation—by which a portion of the crystallizable sugar would be lost.

The planter ought, in the first place, to direct his attention particularly to the process of preservation from fermentation

by the bisulphite of lime; for the application of the precipitating agents destroys the uncrystallizable sugar, which forms a colored compound with the lime, and operates injuriously in the process for cleansing the insoluble saccharates. The alkaline state being desirable in the manufacture of sugar, it is strongly recommended, when no one of the antiseptic agents is employed, to render the solution alkaline, by means of lime, added with great care, either at the rasping-machine or at the crushing-mill.

The patentee claims, First,—the use of bisulphites or acid sulphites (particularly the acid sulphite of lime) as preservative agents against fermentation, and as depurators of vegetable juices containing crystallizable sugar. Secondly,—the use of the various antiseptic substances, hereinbefore mentioned, as employed as preventatives to fermentation in saccharine fluids. Thirdly,—the employment of baryta, strontia, and of the sulphurets of barium and strontium, of lime, and other metallic oxides, for the precipitation and separation of the crystallizable sugar in the state of insoluble saccharates. Fourthly,—the method of producing the above-mentioned saccharates, and of separating the sugar in a state of purity. Fifthly,—the employment of the bisulphites and acid sulphites (particularly the acid sulphite of lime) as defecators of fluids containing crystallizable saccharine matter.—[*Inrolled February*, 1849.]

To WILLIAM BUCKWELL, *of the Artificial Granite Works, Battersea, Surrey, civil engineer, for improvements in compressing or solidifying fuel and other materials.*—[Sealed 28th March, 1849.*]

THIS invention consists in a method of compressing or solidifying coke, coal, or other material applicable as a fuel, by subjecting the same to percussion in moulds, and thus converting it into solid blocks.

The operation of compressing or solidifying is effected by causing the fuel (say coke in a crushed state, mixed with a small quantity of liquid) to be fed into a strong cast-iron mould, lined with wrought iron, case-hardened, and fixed firmly on a strong foundation. Within the mould a ram works; and the patentee prefers to actuate it by the mechanism known as

* Since the above patent was sealed, the patentee has, by means of a disclaimer, struck out the words "and other materials" from the title, which now reads thus—"improvements in compressing or solidifying fuel."

a steam-hammer; although other means of producing the requisite percussion may be adopted: in making hexagonal blocks of about 50 square inches transverse section, the patentee has used a hammer of about 3 tons weight, capable of acting through a space of 4 feet, and making 50 blows per minute. As the fuel is fed into the mould, the ram or hammer beats it down, and thus compresses or solidifies it; and the best effect is said to be produced by introducing small quantities at a time between the successive blows of the ram. When a block of the required size has been formed, it may be removed from the mould; but it is expedient that the block should remain therein for a short time. For this purpose, the patentee makes the mould of double the depth of a block; so that when one block has been formed, and forced into the lower part of the mould, a plate of iron, that fits the interior of the mould, may be placed upon it, and the next block formed thereon in the upper part of the mould; and then the block at the lower part of the mould is to be driven out and the other block to take its place. In order that this may be readily effected, the plate beneath the lower block is supported by a prop, which works as a piston within a steam cylinder; this prop, whilst a block is being formed, remains bolted or fixed; but when the block has been formed, the prop is unfixed, and will be caused to descend into the cylinder by the succeeding blow of the ram, so as to release the lower block of fuel from the mould; and when this block has been removed, the prop is raised (by the admission of steam into the cylinder) into its place under a plate in the mould, where it is again fixed and the process repeated. In the first instance, and before any block of fuel has been formed in the mould, it will be necessary to place in the lower part of the mould, beneath the iron plate used for separating the successive blocks, a block of wood or other material capable of bearing the blow, and which, being driven out after the first block of fuel has been formed, may be laid aside; but it is desirable to use it when finishing work, so as to leave such block in the mould instead of a block of fuel. The blocks of fuel may be subjected, in a room or chamber, to a temperature somewhat higher than the external air; but this is not essential, as the action of the external atmosphere, in fine weather, will be sufficient to produce the same effect.

The quantity of liquid to be applied to the coke or other fuel, before compressing or solidifying it, will vary according to circumstances: sometimes it will be sufficiently damp from exposure to the atmosphere; but in general it will be neces-

sary to mix with it a small quantity of water or other matter in a fluid state. If bituminous matter, such as tar, or other matter in a liquid state, be used in combination with the fuel, the water is to be omitted or proportionately diminished.

The patentee claims, as his invention, the compressing or solidifying of fuel in moulds by percussion.—[*Inrolled September*, 1849.]

To GODFREY ANTHONY ERMEN, *of Manchester, in the county of Lancaster, cotton-spinner, for his invention of certain improvements in machinery or apparatus for twisting cotton or other fibrous substances.*—[Sealed 8th February, 1848.]

THESE improvements relate principally to machinery employed for slubbing, roving, doubling, and spinning, or any other twisting process wherein spindles are used; and consist, first, in the construction and application to such machinery of a certain novel and improved form or description of bearing, bolster, or collar and step, together with an improved form or construction of support-rail or plate for the same,—the bearing or bolster, and rail or plate, being so constructed and arranged as to allow of the said bearing or bolster inclining its vertical central line parallel to the central line of the spindle which passes through it, by the impulse of the spindle alone, or otherwise, and also to revolve or oscillate. Secondly, in the construction and application to the aforesaid machinery of a certain novel and improved form or construction of drag-plate or friction-plate, to be formed with, or attached to, the above-mentioned bearing, bolster, or collar, and so constructed and arranged as to be capable of inclining horizontally at right angles to the central line of the spindle (which revolves within its centre) by the mere impulse of the spindle or otherwise.

In Plate XI., fig. 1, is an elevation of an ordinary throstle-spindle and flyer, shewing one method of applying the invention thereto,—the drag-plate or friction-plate and tube being shewn in section; fig. 2, is a plan or horizontal view of the bolster or bearing; and fig. 3, is a similar view of part of the support-rail or plate; fig. 4, is an elevation of the throstle-spindle and flyer, shewing another arrangement of bearing or bolster and friction-plate or drag-plate; and fig. 5, is an elevation of a "mule-spindle," shewing a further modi-

fication of the bearing or bolster, and also a different form or construction of support or rail.

In fig. 1, the line *a, b, c,* continued in the direction of the dotted line *d, e, f,* forms a circle;—this circle *a, b, c, d, e, f,* takes the outline or greatest circumference of a side view of a globe or ball, whose upper pole is at *e,* and whose lower pole is at *b*; and the globe or ball is perforated with a hole, of any required diameter, from *b,* to *e.*—*g, g,* represents a support-rail or plate, having a circular opening *h,* which may be either bored straight through the rail, or tapered, or curved (as represented in the drawing); but the greatest diameter thereof must be less than the greatest diameter of the above specified globe or ball *a, b, c, d, e, f.* The upper plate *i,* in fig. 5, is constructed in a similar manner, but inverted. Now, if the ball *a, b, c, d, e, f,* with the spindle passing through it, is dropped into the opening *h,* of the support or rail *g, g,* it will be obvious that the globe or ball will acquire the double property of inclining its perpendicular line parallel to the centre line of the spindle, and also of revolving round its centre, according to the impression or impulse given to it. The plate *i,* fig. 5, is applied above the greatest diameter of the globe, for the purpose of holding down the ball, in cases where it may be required. *j, j,* (figs. 1, and 4,) is the foot-rail; *k,* is the step, and *l,* its support; both of which are constructed after the principle laid down above,—the ball *k,* acquiring the same property of inclining its vertical line, and also revolving round its centre, according to the impulse or impression given it: the support *l,* is fastened with a set-screw, like any other common spindle-step, into the foot-rail *j, j.* The surface *m, m,* fig. 1, at right angles to the central line of the globe, may be formed in any part of the globe, betwixt its two poles *b,* and *e*; and this surface, which is at right angles to the central line of the globe, may be formed at its upper pole or above its upper pole, and firmly connected thereto, as represented by the ball *o,* fig. 4. The small projections *p, p,* of the ball, fig. 1, have corresponding slots left in the plate or support *g, g,* (see fig. 3,); and these projections merely serve to prevent the ball or bolster from being raised out of its place by any accident during the working thereof. The shape of the plate *g, g,* and of the foot-rail *j, j,* or of the lower part of the bolster, ball, or the foot-step and its supports, may be altered; but those parts upon which the properties above specified depend, form the subject of the present invention.

The patentee claims, First,—the construction of a bearing,

bolster, or step, and its application to spindles for spinning, doubling, roving, or any twisting process—which bearing shall have the property of inclining its central line parallel to the central line of the internal shaft or spindle, by the impulse of that shaft or spindle, or otherwise, and also of revolving; which two properties are given to the bearing, bolster, or step, by assuming its original figure to be that of a ball, and by supporting this ball in or by any point, line, or place, or points, lines, or places, betwixt its lower pole and its greatest circumference. Secondly,—the construction of a bearing, support, drag-plate, or friction-plate, and its application to the particular purposes of spinning, doubling, roving, or twisting of any kind—which bearing, support, drag-plate, or friction-plate, shall have the property of inclining horizontally, at right angles to the central line of the shaft or spindle (which revolves within its centre), by the mere impulse of the spindle or otherwise; which property is given to the said bearing, support, drag-plate, or friction-plate, by assuming its original figure to be that of a ball; which ball is either furnished with a plate, at or above its upper pole, at right angles to the central line or its perforated centre; or, secondly, which ball is deprived of some part of its upper hemisphere, by which means this plate or bobbin-bearing is formed; and which ball is supported in or by any point, line, or place, or points, lines, or places, betwixt its lower pole and its greatest circumference. Thirdly,—the construction of a bearing, bolster, or step, of both improvements combined; which bearing, bolster, or step, &c., should have the property of both improvements combined;—this being obtained by supporting the ball-shaped bearing, bolster, or step, with its friction-plate and tube, by a number, greater than one, of points or lines, or any suitable quantity of surface. Fourthly,—any mode of supporting and fastening that will allow the bearing, bolster, or step, as qualified by the above specified claims, to incline its perpendicular line, and also to revolve.—[*Inrolled August*, 1848.]

To Josiah Lorkin, *of Ivy-lane, in the City of London, merchant, for an improved instrument or apparatus for beating or triturating viscous or gelatinous substances.*—[Sealed 20th September, 1849.]

This invention consists in certain instruments or apparatus for beating or triturating eggs, butter, cream, or other matters of a viscous or gelatinous nature.

In Plate XI., fig. 1, is a vertical section of an instrument, constructed according to this invention; fig. 2, is a plan view thereof; and fig. 3, is a plan view of the lid belonging to the same. *a*, is a cylindrical vessel, made of wood, earthenware, metal, or other suitable material. *b, b,* are pins or beaters, affixed to the inner surface of the vessel *a,* in three rows, each consisting of five pins, which are so situated that the pins of each row are opposite to the intermediate spaces between the pins of the opposite row. *c,* is the lid, formed with two projections c^1, c^1, to enter into a groove *d,* in the rim of the vessel. After the eggs, or other matters to be beaten, have been introduced into the vessel *a,* the lid is put on; and it is secured by causing the projections c^1, c^1, to enter into the groove *d,* through the parts *e, e,* (which are cut away or removed), and then turning the lid partly round. The vessel *a,* is then taken in the hand and shaken to and fro with such a degree of force as to cause the contents to be driven successively against the top, bottom, and sides of the vessel; and the eggs or other matters are thereby brought to the required triturated and frothy state.

Fig. 4, is a vertical section of another instrument,—the pins or beaters *b,* of which, instead of being affixed to the inner surface of the vessel *a,* project radially from a spindle *f,* situated at the centre thereof, and attached to the lid *c,* of the vessel.

Fig. 5, is a vertical section of an instrument, constructed with projecting ledges *g, g,* in the interior of the vessel *a,* which produce the same effect as the pins or beaters *b.*

Fig. 6, is a vertical section, and fig. 7, a plan view of an instrument, consisting of a vessel *a,* in the interior of which are fixed two diaphragms *h, h,* of wire gauze (the meshes thereof being from three-eighths of an inch to half an inch, and upwards, in size); or, in place of wire gauze, perforated diaphragms of metal or earthenware may be substituted. The three last-mentioned instruments are used in the same manner as that first described.

Fig. 8, is a longitudinal section, and fig. 9, a transverse section of an instrument or apparatus adapted for beating large quantities at a time. It consists of a vessel *i,* containing a horizontal spindle *j,* on which is mounted a barrel *k,* having a series of points or beaters *l,* projecting radially therefrom. The spindle *j,* is caused to rotate, with the beaters, by turning the handle *m;* or, when great speed is required, a wheel is fixed upon the spindle, and motion is communicated to it through the medium of suitable gearing.

Fig. 10, is a vertical section and fig. 11, a plan view of an instrument, consisting of a vessel *n*, containing a vertical spindle *o*, which carries the radial beaters *p*, composed of wires or of perforated diaphragms of metal or other suitable material. The beaters are caused to rotate in opposite directions, alternately, by placing the upper end of the spindle between the palms of the hands, and then moving the hands quickly in opposite directions.

The patentee states that he does not restrict himself to the number, size, position, order, or arrangement of the beaters employed in the said instrument or apparatus; or to making the same wholly or partially of any particular material or materials; or to any specific means of giving a reciprocating or rotary or whirling motion to the same. He claims the beating or triturating of viscous or gelatinous substances by means of an instrument or apparatus consisting of a cylinder or other suitable vessel, containing in the inside thereof projecting beaters or interstitial diaphragms, as above described.—[*Inrolled March,* 1850.]

To HENRY WATSON, *of the town of Newcastle-upon-Tyne, brass-founder, for improvements in valves and cocks.*—[Sealed 12th October, 1849.]

THE object of this invention is to construct the plugs, blocks, or keys of valves and cocks in such manner that they will close the passage through the latter water-tight; while, at the same time, the expense of forming and keeping their working surfaces in proper order will be less than when those surfaces are made of brass or other suitable metal; and this is effected by facing the working surfaces with yielding or flexible materials.

In Plate XII., fig. 1, is a vertical section of a valve, constructed according to this invention, and fig. 2, is a horizontal section thereof. *a*, is the passage or water-way. *b*, is the block or valve, the inclined surfaces of which are faced with leather, felt, gutta-percha, or other suitable elastic or yielding material *c*; this material is secured upon the block or valve *b*, by driving on a ring *d*, and fixing the same by screws; and the flexible material is kept in a suitably distended state by means of the plates *e*, which are caused to press against it by screwing up the nuts on the screw-bolts *f*. The block or valve *b*, is raised or lowered by turning the screwed spindle *g*, which works in a nut *h*, fitted somewhat loosely in the centre of the

valve; and the valve is guided in its ascent and descent by ribs or feathers *i*, projecting from the sides of the valve-chamber and entering grooves formed in the valve. By thus making the working surfaces of the valve of yielding or flexible materials, the closing of the water-way perfectly tight is always ensured, although grit or dirt should get between the valve and its seat; whereas if the working surfaces were formed of metal, the introduction of grit or dirt would prevent the valve from fitting perfectly tight in its seat.

Fig. 3, is a vertical section, and fig. 4, a horizontal section of an improved cock. *b*, is the block or plug, which closes the passage *a*, and is raised and lowered by turning the screwed spindle *g*. The inclined surface of the block which fits against the parts *a**, of the water-way is faced with a yielding or flexible material *c*; and this material is secured to the block and kept distended by the means above described.

The patentee claims, as his invention, the facing the inclined surfaces of the parts *b*, with yielding or flexible materials, as above explained.—[*Inrolled April*, 1850.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for an invention of certain improvements in steam-boilers,—being a communication from abroad.*—[Sealed 23rd August, 1849.]

The object of these improvements is to construct steam-boilers in such a manner that great heat may be obtained and applied, to effect the generation of steam, with a considerable economy of space. This is effected by increasing the intensity of the fire in proportion to the quantity of steam required, and applying a larger quantity or given amount of heat to a less extended heating surface than is at present employed; whereby the production of steam may be effected more economically than in boilers of the usual construction.

In Plate XI., fig. 1, represents, in longitudinal vertical section, a boiler constructed according to the present invention; fig. 2, is a transverse vertical section; and fig. 3, is an external elevation. *a, a,* is the fire-place; and *b, b,* are the fire-bars, supported at both ends as usual, and surrounded by a wall of fire-bricks *c, c,* built upon a ledge or platform *p*, made of sheet or wrought-iron, and set in the masonry. The wall of fire-bricks thus forms a kind of shallow well, the bottom of which is formed by the fire-bars *b, b.* Fuel is supplied to the fire-

place through an opening *d*, (fig. 2.) The upper part *e*, of the fire-place, where the heat from the fuel is developed, is made conical, with an aperture at the top for the escape of the non-combustible gases up the flue *f*, *f*. The water of the boiler surrounds this conical fire-chamber and vertical flue; and the effect of this arrangement is, that the greater portion of the rays of heat, which radiate from the incandescent fuel, impinge against the sides of the cone, and are absorbed by the water which surrounds the same; while the rest are reflected back upon the fuel, and the heat in the fire-place is thereby very considerably increased; so that, as the combustible gases are evolved from the fuel, they are immediately consumed, instead of passing into the flue or chimney and escaping uselessly into the atmosphere. The conical chamber *e*, *e*, and the flue *f*, *f*, leading therefrom, the inventor prefers to construct of sheet copper,—that metal being a much better conductor of heat than iron. The base or lower part of the conical chamber *e*, *e*, is secured by screw-bolts to the ledge or platform *p*, as shewn in the drawing. *g*, *g*, is the outer casing of the boiler, made of sheet-iron, and surrounded on all sides by a bed of sand, or other bad conductor of heat, for the purpose of preventing, as far as possible, loss of caloric by radiation. The boiler is, by means of a supply-pipe *h*, kept nearly full of water, as shewn; and the steam that is generated in the boiler passes therefrom through a pipe *k*, into the steam-chamber *i*, wherein any water that may come over with the steam will be deposited; and only dry steam will be allowed to pass from the upper part of the vessel *i*, down the steam-pipe *j*, to the engine. The steam-chamber *i*, is furnished with a safety-valve *k**, and the upper end of the flue or chimney *f*, is provided with a throttle-valve, for the purpose of regulating the draft. Air, to support combustion, is supplied by the pipe *l*, to the ash-pit, where it becomes warmed before it acts upon the fuel. When it is requisite to remove the conical chamber *e*, and copper flue *f*, and replace these parts by new ones, the top or cover *g**, of the boiler is first removed; the base of the cone *e*, is then detached from the cast-iron platform *p*, and the feeding aperture *d*, from the sides of the vessel *g*; after which, the flue *f*, and conical chamber *e*, are free to be lifted out, without deranging or displacing anything else, and a new chamber *e*, may be readily adapted to the boiler.

At figs. 4, and 5, two modifications of the steam-generator, above described, are shewn;—the principle difference being that of form, which will, however, in some measure affect the

combustion of the fuel. At fig. 4, the fire-bars are placed at the bottom of a fire-place, constructed in the brick-work, in the form of an inverted cone. The combustible vapors, as they are given off from the fuel in the fire-place, rise into the enlarged conical heating chamber, and are consumed by the intense heat which is there generated and kept up. When a greater degree of heat is required, the inventor proposes to make the sides of the fire-place perpendicular, instead of inclined as at fig. 4. By this means a greater extent of grate or fire-bars would be obtained, and a much larger body of incandescent fuel might be kept up than in the fire-place shewn at fig. 4. Fig. 5, is another modification, in which there is a larger grate or more extended surface of fire-bars than in fig. 4; the sides of the fire-places being inclined inwards, and leaving a contracted opening above for the passage of the heated gases into the enlarged conical fire-chamber *e**, of the boiler. In order to prevent the heat from passing uselessly from the chamber *e**, up the chimney, a reflector *m*, made of fire-clay, is suspended, by means of a rod, under the opening which leads from the top of the enlarged conical chamber *e**, to the chimney. By means of this rod the reflector *m*, may be raised and lowered, as desired, and the draft in the fire-place can be thereby regulated. This arrangement admits of a very intense heat being generated in the fire-place *a**, and the gases passing through the opening *f**, in a highly heated state, into the enlarged fire-chamber *e**, above, where they give out their caloric to the water which surrounds the chamber.

In order to set forth with clearness the nature of his improvements, the inventor makes the following observations on the principle of the generation of steam:—"It is based," he says, "upon the difference in density or temperature of two bodies, viz., the incandescent fuel and the water, which have always a tendency to balance themselves or maintain an equilibrium. Thus, in order to maintain a given expansive force of steam, certain conditions are necessary, viz., first, the combustion of a given quantity of fuel in the fire-place; second, a certain temperature of the fluids in the flue or chimney must be maintained, dependent of course upon the temperature required in the boiler; third, the metal, of which the inner parts *e*, and *f*, of the boiler are constructed, and which transmit the caloric from the fire to the water, must be one of the best conductors of heat, and be placed in a condition to conduct the heat as quickly as possible from the fire to the water; and fourth, the metal of which the outer part of the boiler is

constructed should be preserved as much as possible from radiating or conducting away the caloric. The above conditions are necessary, because the volume of steam will correspond to the volume or quantity of fuel employed; and upon the temperature maintained in the chamber *e*, and chimney *f*, will depend the rapidity with which heat will be transmitted and steam can be produced;—the quicker and more powerful the transmission of caloric may be, the less extent of surface will be required: the pressure in the boiler will correspond with, or be in proportion to, the temperature of the water; and this pressure will increase or diminish as the temperature of the water increases or diminishes. Now, the rays of heat being divergent, and the temperature of the gases, which pass off by the orifice of the chimney, being in direct proportion to the intensity of the fire, or equal to that of the steam contained in the boiler, we may conclude that the heating surface of the chamber *e*, and flue *f*, is more than sufficient to take up and transmit the largest quantity of caloric which can be given out by the fire; and that the speed with which this heating surface transmits the caloric to the water is equal to the rapidity with which the caloric is given off from the incandescent fuel; and, further, that the practice of using the large extent of heating surface, which it has always hitherto been considered necessary to employ, in constructing steam-boilers or generators, is not derived from a principle or natural law, but merely from a rule laid down by constructors and engineers, and admitted *a priori*."

The patentee claims the combination, with a vertical flue, of a conical fire-place or enlarged heating-chamber at the lower part of the same, or any mere modification thereof; whereby the intensity of the fire in the fire-place may be greatly increased by a portion of the caloric given out from the incandescent fuel being reflected back upon the fuel or combustible gases in the enlarged heating-chamber; and which fuel and combustible gases are thereby more effectually and economically consumed than in steam-boiler furnaces, with a more extended heating surface and less intensity of heat.—[*Inrolled February*, 1850.]

To Samuel Adams, *of West Bromwich, Staffordshire, organist, for improvements in mills for grinding.*—[Sealed 16th November, 1848.]

This invention consists in improvements in metallic mills for grinding coffee, malt, and other substances.

In Plate XII., fig. 1, is a vertical section of a mill, the

moveable cutter or grinder of which rotates in a horizontal plane; fig. 2, is a horizontal section thereof; and fig. 3, is an edge view, and fig. 4, a side view of the moveable cutter detached. *a*, is the fixed cutter, consisting of a plate, having a conical opening through it, formed with teeth in the usual manner,—the cutting surface being made, by preference, of steel. *b*, is the moveable cutter, formed with teeth, which are also preferred to be made of steel; it is affixed to an axis *c*, which turns in bearings at *d*; and it is suitably adjusted to work with the fixed cutter *a*, by means of a set screw *e*. The moveable cutter *b*, is furnished with a series of inclined planes or projections *f*, projecting radially from the periphery thereof; by the application of which, it is stated that the mill will be enabled to perform a larger amount of work; as they not only prevent the grain or other matters from getting away from between the cutting edges of the mill, but they also, by reason of their inclined position, press the grain or other matters into the angular space between the cutters or grinders *a*, and *b*. The axis *c*, is connected by the bevil-wheels *g*, with the axis *h*, which carries at one end a fly-wheel *i*; and the other end is squared to receive a winch-handle, by means of which rotary motion is communicated to the cutter or grinder *b*. *j*, is a shield, which serves to relieve the upper side of the cutter *b*, from the pressure of the grain or other matters to be ground, also to guide the grain or other matters into the space between the cutters, and to cover and protect the bevil-wheels *g*. *k*, is the cover of the mill, to which a hopper *l*, is fitted.

Fig. 5, is a vertical section of another mill, constructed according to this invention, the moveable cutter of which rotates in a vertical plane; and fig. 6, is a vertical section taken at right angles to fig. 5. *a*, is the fixed cutter, which, like that in the mill above described, consists of a plate, having a conical opening through it, with teeth formed therein. *b*, is the moveable cutter, fixed on the axis *c*, which is caused to rotate by turning the handle *m*. The cutter *b*, is provided with inclined planes or projections *f*, as before, to prevent the grain or other matters from getting away from the cutters and to force the same in between the cutters; and the grain is prevented from coming in contact with the end of the cutter *b*, by the shield *j*.

The patentee claims, Firstly,—the application of a shield *j*, as before described. Secondly,—the application of inclined projections, surfaces, or planes *f*; and the manner of constructing and combining the cutters *a*, *b*.—[*Inrolled May*, 1849.]

To John Frederic Bateman, *of Manchester, in the county of Lancaster, civil engineer, and* Alfred Moore, *of the same place, civil engineer, for certain improvements in valves or plugs for the passage of water or other fluids.*— [Sealed 18th January, 1848.]

This invention of improvements in valves or plugs, for the passage of water or other fluids, applies principally to cocks or valves used for drawing off water from the main or service-pipes of water-works, for the supply of mills, works, or buildings—for the extinction of fire—the watering of roads, streets, or gardens—the irrigation of land—the cleansing of water-pipes—the flushing of sewers, and other similar purposes; and relates, first, to the use of a globular-form valve, of a specific gravity lighter than water, and constructed of, or covered with, vulcanized India-rubber, gutta-percha, or other compressible elastic substance,—the closing of such valve being effected by the pressure of the water; secondly, to the use and application, for the same purposes, of a valve of a globular form, of the same or greater specific gravity than water, constructed or coated as above described, and closed in a similar manner; thirdly, to opening valves for the passage of fluids by means of a moveable opening key, consisting of a hollow tube or pipe, with proper adjuncts, so applied as, without the aid of any thread or screw upon the barrel, or any fixed part of the valve itself, or the parts necessarily permanently connected therewith, to force the valve open against the pressure of the fluid,—the key or tube being so constructed that the fluid, when released, shall pass off through the said tube.

In Plate XII., the invention is shewn as applied to a street cock or plug. Fig. 1, shews the improved valve or cock in section,—the opening key or tube being in elevation and disconnected therefrom; and fig. 2, is a section, shewing the valve open, and the opening-key connected thereto. *a, a,* is the branch or connecting-pipe from the water-main, and to its flange is bolted the valve-box *b, b.* The neck of the valve-box is closed by means of the globular valve *c,* formed of, or coated with, vulcanized India-rubber, gutta-percha, or other compressible elastic material,—the pressure of the water being sufficient to keep the valve closed. *d, d,* is the discharge or drawing-off tube, furnished at its upper end with a screwed nozzle *e,* for screwing on the hose-pipe. *f, f,* is a bracket, fixed upon the elbow of the pipe *d,* for the purpose of carrying the internal screwed nut *g,* (fig. 2,) which turns loosely therein,

but is kept in its place by a pin *h,* (fig. 1,) working in a groove upon the outside of the nut *g.* Upon the upper part of the nut *g,* is fixed the winch-handle *i.* *k,* is a screw, the upper part of which works in the nut *g,*—the lower part being squared and working through the guide *l.* At the lower end of the screw *k,* the catch *m,* is attached by a joint. When it is desired to discharge or draw off water from the main through the plug or cock, the opening-key is taken to the plug, and the part *n,* thereof is lowered into the neck of the valve-box *b, b,* until the lower end of the tube rests upon the valve *c;* at the same time the lower end of the catch *m,* (it having been sufficiently depressed prior to the insertion of the tube) passes outside or slides over the projecting rim *p,* upon the valve-box, and falls by its own gravity under such projecting rim; thus locking or attaching the opening-key or tube to the valve-box. The opening-key being thus attached, the turning of the winch-handle *i,* will force the tube downwards, and gradually depress the valve *c,* when the water will flow freely around the valve, and upwards through the discharge-tube *d.* When it is desired to withdraw the opening-key or tube and close the valve, the handle must be turned in the reverse direction, which will allow the tube *d,* to rise in the neck of the valve-box *b,*—it being forced upwards by the pressure of the water acting on the ball or valve *c,* until the valve closes the aperture. The turning of the winch-handle being then continued, the projecting part *q,* of the catch, acting against the flange *r,* upon the discharge-tube, will throw the catch into the position seen at fig. 1, when the key or tube may be withdrawn; the catch passing clear of the rim *p.* The opening-key may be attached to the plug or cock in other ways, without the aid of screws; such as by projecting lugs or ears, under or by means of which the opening key, or the tube through which the water is drawn off, may be secured or connected; or in various other ways, by which the same purpose would be effected, and which would readily suggest themselves to a practical mechanic. The valve, just described, will allow of the escape of air from water-pipes, by the falling or opening of the valve, whenever the water is not in contact with the valve, or the pressure is not sufficient to keep the valve closed.

The patentee claims, First,—the application, for the purpose of drawing or letting off water or other fluids, of a valve of a less specific gravity than water, constructed of, or coated with, vulcanized India-rubber, gutta-percha, or other suitable compressible elastic material; and which closes, or is kept

closed, by the pressure of the water. Secondly,—the application, for similar purposes, of a globular valve (of the same or greater specific gravity than water, and constructed or coated as above described) which, without mechanical aid, will close by the pressure of the water. Thirdly,—the opening of valves by means of a key or tube, so applied as to force the valve open against the pressure of the water or other fluid, and through which key or tube the fluid escapes;—such key or tube being attached to the box or barrel, or other fixed part of the valve, without the aid of a thread or screw on such box, or other fixed part.—[*Inrolled July*, 1848.]

To Francis Hastings Greenstreet, *of Liverpool, engineer, for certain improvements in hydraulic engines.*—[Sealed 2nd December, 1848.]

This invention consists in an improved arrangement of valves and valve-gearing for hydraulic engines.

In Plate XII., fig. 1, is an end view, fig. 2, a plan view, and fig. 3, a horizontal longitudinal section of an hydraulic engine. *a*, is the cylinder of the engine, provided with a piston *b*, and piston-rod *c*, and connected by a pipe *d*, at each end, with the valve-box or chest *e*.—*f*, *g*, *h*, *i*, are four valves, each consisting of a circular plate, which has four radial openings cut in it, and works against a face-plate similarly perforated, in the same manner as the regulator of a locomotive engine, or the register-plate of a stove. The four valves are fixed on one spindle *j*, to which a reciprocal motion is imparted by the action of the weighted lever *k*, falling alternately in opposite directions; which motion of the spindle is communicated to all the valves at once, and is just sufficient to open and shut them at the required time; and the valves are so adjusted on the spindle that, as two of the valves open, the other two close. *l*, is the pipe that supplies the water to the machine; and *m*, *m*, are the exhaust-pipes, through which the water is discharged after acting on the piston *b*.

The action of the engine is as follows (supposing the valves *f*, *h*, to be open and the valves *g*, *i*, shut):—A cock or valve in the pipe *l*, being opened, the water passes from the reservoir into the valve-box *e*, and thence through the valve *h*, into the cylinder, where it presses upon the piston and forces it to the other end of the cylinder; and any water previously occupying the cylinder, on the opposite side of the piston, is expelled, and passes away through the valve *f*. On the piston

arriving at the end of the stroke, the valves are reversed by the gearing, as hereafter explained; then the water which had just acted on the piston passes away through the valve *i*; and the pressure of the column of water is brought to bear on the opposite side of the piston through the valve *g*. In this manner an alternate reciprocating motion is kept up, similar to the action of the common reciprocating steam-engine.

The arrangement of gearing for shifting the valves is shewn at figs. 1, and 2. *n*, is a diagonal slide, which is firmly connected to the piston-rod by the rod *o*; consequently it has the same length of stroke as the piston; and it is caused to work parallel thereto by guide-rods *p*, affixed to it, and sliding in guides *q*. This diagonal slide gives motion to the weighted lever *k*, which turns freely upon the valve-spindle *j*, without moving the latter, until a pin, which projects from the back of the lever into a slot in the collar *j**, of the valve-spindle, comes in contact with either extremity of the slot. Thus, when the piston is put in motion, the diagonal slide *n*, by sliding under the lever *k*, will gradually lift the same; and, by the time the piston arrives near the end of the stroke, the lever *k*, will be brought to a perpendicular position and fall over in the opposite direction, carrying the valve-spindle partly round, and thus reversing the valves. The object of using this description of valve-gearing is, to prevent the engine from coming to a rest near the end of the stroke (when only imparting a reciprocating motion and working without a fly-wheel), which would be likely to happen if there was no provision made for instantaneously moving the valves at the required time; as, otherwise, the hydrostatic pressure would be equalized on both sides of the piston, as soon as the valves were partially shifted, and the piston would come to a rest, without it had acquired sufficient velocity to carry it to the end of its stroke and fully to shift the valves.

After describing the engine, the patentee proceeds to point out (in the following manner) what he considers to be the advantages it possesses, and the parts he claims as his invention, which is in the arrangement and combination of the valves:— The valves are so constructed that they are wholly unaffected by the pressure of the column of water, and work as easily under an enormous pressure as they do when free from any pressure; for it will be perceived that, in the position the valves are shewn in fig. 3, the pressure acts on the back of the valve *g*, and also upon *i*; and these being connected by the spindle *j*, the pressure on one counteracts the pressure on the other, and thereby prevents any tendency to force the

valves against their face-plates: when the valves are shifted, the pressure upon *h*, counteracts the pressure on the valve *f*. The concussion, which would arise from the motion of the column of water being suddenly arrested, is entirely prevented by the use of the above arrangement of valves; the flow of water, in this case, being uninterrupted; as the current is not stopped, but only diverted to the opposite sides of the piston at each change of the valves; for, as the valve *g*, shuts, exactly in like proportion the valve *h*, opens, and *vice versâ*. These ends may be attained by different forms of valves, such as common clack or hinge-valves, worked by a tappet on the piston-rod. The patentee, therefore, does not confine his invention to any particular form of single valve; but he recommends the form of valve described, as giving a large opening for a small motion.

He claims the so arranging and combining of four distinct valves, connected by a spindle or a series of jointed rods, as the case may require, in such a manner that the pressure on the back of one valve counteracts the pressure upon the other; and also that as one valve, communicating with the head of water, shuts, exactly in like proportion the other valve opens,—thus preventing the flow of water from being arrested, and thereby causing a concussion, but merely diverting the direction of the flow of water to the opposite sides of the piston.—[*Inrolled June,* 1849.]

To FLORENTIN JOSEPH DE CAVAILLON, *of No.* 8, *Rue de la Paix, Paris, in the Kingdom of France, chemist, for certain improvements in obtaining carbonated hydrogen gas, and in applying the products resulting therefrom to various useful purposes.*—[Sealed 1st August, 1849.]

THE patentee, in commencing his specification, says, the substance which is generally employed for the manufacture of carburetted hydrogen gas is pit-coal; but, in place of this substance, other materials may be also employed. As a substitute for, or in combination with, pit-coal, the following materials are proposed to be used, viz., bones, kitchen stuff, graves, the residuum of suet, tallow, or other animal waste, the residuum of seeds, or other oleaginous matters, spent-bark, sawdust, and also sawdust or pulverized or reduced wood, that has been used for the purification of oils, also peat or turf, either pulverized or in small pieces. For the purpose of making gas, any of these materials may be taken

separately, or all of them may be mixed together in greater or less proportions,—that is to say, without being mixed in any definite proportion (except that 50 per cent. of the compound should consist of coal, and the remainder of the other substances, either in equal or unequal proportions, or of some of them only, if the others cannot be conveniently procured). These materials are first consolidated or caused to adhere together, either by means of some gummy or resinous matter, or by some empyreumatic oil, or the molasses of sugar; and, after being properly mixed, they are introduced, by means of a shovel, into retorts, such as are usually employed in gas-works; and the materials are then submitted to a high temperature for some hours, for the purpose of being distilled, in the same manner as pit-coal is operated upon in ordinary gas-works. This having been done, the following products are obtained, namely,—first, a very fine carburetted hydrogen gas, of high illuminating power; second, animal charcoal; third, animal and vegetable charcoal in powder (this product may be employed for various purposes, such as for the preparation of manure); fourth, empyreumatic oil, mixed with tar; and fifth, very rich ammoniacal water.

The materials employed for the preparation of a powder for purifying the gas, and the manner of using the same, are as follows:—Sulphate of lime (which is commonly known as plaster, when calcined) is the principal ingredient, as the mixture contains at least 50 per cent. of this substance. Old plaster, which has once been used for building, is preferred to be used. The patentee remarks that, as scientific men have always considered sulphate of lime artificially made is the same substance as the sulphates of lime found in nature, he therefore intends to include, in the preparation of the purifying powder, any artificial or natural sulphates, without reference to their origin, or from whatever process they may have been obtained. He particularly prefers the sulphates derived from the manufacture of composition or stearine candles; and also the sulphates obtained from the processes of purifying oils, or other substances which, in their preparation or manufacture, give, as one of their products, artificial sulphates of lime.

In combination with the sulphate of lime, either natural or artificial, he employs, 2ndly, coke finely pulverized, and sifted river or other sand, not too fine; 3rdly, pulverized vegetable charcoal; 4thly, pulverized animal charcoal; 5thly, sawdust; 6thly, pulverized peat or turf; 7thly, spent-bark (tannin), reduced to powder; and, 8thly, sulphate of lead mixed with oxide of lead. As the situation of the works, and other cir-

cumstances, may render it difficult to obtain a regular supply of all the materials above mentioned, the patentee does not think it advisable to state any precise quantities or proportions in which the said matters may be mixed for the preparation or composition of the purifying powder; as it may sometimes be found convenient to increase the proportions of some, or diminish the quantity of others, or, in some cases, to omit some of the ingredients altogether. All the materials to be employed in the preparation of the purifying powder must be pulverized; and, when they are all properly mixed together, they must be wetted with dilute sulphuric acid, or acidulated water, weighing from six to seven degrees of Beaumé's acid weighing apparatus. This wetting operation should be conducted in a similar manner to that adopted for adding common water to the lime which is usually employed for purifying gas from sulphuretted hydrogen.

If the sulphate of lime which is to be employed in the purifying powder is artificial, and obtained from some manufacture or process, then it will not be necessary to add any sulphuric acid; but it will be always necessary to wet the mass, which may be done with water. The purifying powder, thus prepared, must be placed upon the sieves or perforated shelves of the purifiers; and, if these shelves are made of metal, it will be advisable to cover them with moss, hay, straw, or some other substance, before placing the purifying materials thereon, in order that the holes in the shelves may not be stopped up by the purifying materials; but, if the shelves are made of wicker work, this precaution will be unnecessary.

The purifying powder may be employed in greater or less quantities, as may be desired. In the gas-works in France, in which this process has been adopted, it has been used in the proportion of two-thirds for one-third of lime,—that is to say, two-thirds of the lime are dispensed with, and, in place thereof, the purifying powder is employed. A certain quantity of lime is, however, made use of in the purifiers, for the purpose of neutralizing the sulphuretted hydrogen;—this lime should be slacked and wetted, when it will take up all the sulphuretted hydrogen that exists in the gas, and the purifying powder will take up the ammonia, and will also partially neutralize the sulphuretted hydrogen, and give to the gas a brilliancy and illuminating power superior to that obtained by the processes now in use.

It is scarcely necessary to say that, when the purifying powder is entirely saturated with ammonia (which will be easily ascertained by applying turmeric test paper to the gas),

it must be replaced by a fresh supply. The same may be said of the lime, which will take up the sulphuretted hydrogen. It is easy to ascertain when the lime is saturated with this gas and should be replaced with fresh lime, by testing the gas by means of paper saturated with acetate of lead, which will become black, upon exposure to the gas, if any sulphuretted hydrogen is present.

From what has been said, it will be understood that the substances employed are of three kinds, viz., those which are naturally purifiers, those which have been made purifiers, and those which are inert. The substances which are purifiers naturally are sulphate of lime, pulverized vegetable carbon or charcoal, animal charcoal, and the sulphate and the oxide of lead. The substance which is artificially made a purifier is sawdust, which, although, in its natural state, inert, becomes a purifier by damping it with from 7 to 8 per cent. of sulphuric acid. The inert substances are sawdust without sulphuric acid, pulverized peat, pulverized spent-bark or tannin, sand, and pounded coke. The purifying powder should be compounded in such a manner that about 70 per cent. in volume of the mixture should consist of sulphate of lime. Of the remaining 30 per cent., about one-third should consist of either of the above-mentioned purifying ingredients, and the remaining portion of the inert matters, such as coke, sawdust, &c.; or the whole 30 per cent. may be composed of the above-mentioned inert substances. It should be remarked, that the purifying powder must always be placed upon the perforated shelves, trays, or sieves of the purifier in such a manner that the current of gas to be purified may pass through it before arriving at the lime. Therefore, if the current of gas is made to ascend, the purifying powder must be placed first upon the perforated shelves of the purifier, and then covered with the lime; and if the current of gas is made to descend, the lime must be placed first upon the shelves, and covered with the purifying powder.—[*Inrolled January,* 1850.]

To Thomas Dawson, *of Melton-street, Euston-square, machinist, for improvements in cutting and shaping garments and other articles of dress for the human body.*—[Sealed 18th October, 1849.]

This invention relates to apparatus for cutting or shaping parts of garments or dress; and it consists in so arranging a series of cutters, for cutting out several pieces or thicknesses

of fabric of the same shape simultaneously, that the cutters may be varied in their combination and positions, so as to vary the shape of the cuts made by them. The patentee is aware that suitably-shaped cutters have been used for cutting out several thicknesses of fabric at the same time, for making gloves and other articles; but, by each of such cutters, pieces of only one particular shape could be cut; and any slight variation in the shape or size of the piece would require a different cutter to produce it; whereas the cutters constructed according to this invention can be altered or adjusted to suit the size or form of the piece required to be produced.

The apparatus arranged according to this invention is represented in Plate XII. Fig. 1, is an elevation, and fig. 2, a horizontal section of a series of cutters suitably combined for cutting out pieces of fabric of the proper shape to form the front of a waistcoat. Fig. 3, is a side view and fig. 4, an edge view of one of the cutters, detached. *a, a,* are the cutters, which are jointed together at their ends, and are provided with screw-stems a^1, whereby they are attached to the lower end of the standards or rods *b*, b^1. The standards *b*, have enlarged heads, which bear against the under side of the perforated plate *c*,—shewn in plan view at fig. 5. The standards b^1, are provided, at their upper ends, with small screw-stems, which pass through the perforations in the plate *c*, and are secured by nuts *d*. The cutters, standards, and perforated plate are thus firmly connected together; and the plate *c*, is secured by bolts *e*, and nuts *f*, to the upper plate or follower *g*, of a press;—suitable filling-pieces *h*, being inserted between the plates *c*, and *g*. *i, i,* are pieces of fabric, placed upon the bed *j*, of the press, beneath the cutters *a*; which, being forced downwards, by the action of the press, cut the fabric into pieces of the desired form.

In order that the cutters may be lengthened or shortened, they may be made in three pieces, as represented in side view at fig. 6, and in transverse section at fig. 7;—one of which pieces *a*, is formed with a dovetailed bead or tongue, which fits into a corresponding recess in the back of the two pieces a^2. For cutting fustians and similar fabrics, cutters with serrated edges are employed, as shewn at fig. 8.

The patentee claims, as his invention, the composing apparatus for cutting or shaping parts of garments or dress, by so arranging the cutters that they may be varied in their combination and positions, so as to vary the shape of the cuts made by a series of such cutters, as above explained.—[*Inrolled April*, 1850.]

Scientific Notices.

ON THE EMPLOYMENT OF PEAT CHARCOAL IN THE ARTS.

There is, perhaps, no subject of enquiry, relating to matters of industry, which has awakened more general interest, or given rise to more sanguine expectation with regard to its influence upon the condition of a certain class of the community, at least, in Ireland, than the application of peat, on an extended scale, as fuel for domestic purposes, and in some branches of manufacture.

The prominent manner in which this question has been treated by individuals, whose position is sufficiently elevated to give them credit in the eyes of the world, has probably led, in many respects, to a false conception of its true merits; at the same time, the extensive introduction of peat into use as a substitute for other descriptions of fuel, promises advantages too great to be treated of slightingly.

Peat, as is pretty generally known, is a substance of vegetable origin; a substance apparently still in a state of transition, still undergoing those chemical changes which sufficed, in the early ages of the world, to convert whole forests into the vast carbonaceous deposits encountered in certain localities, under the form of coal. The conversion of vegetable matter into peat, is a process which, under favorable circumstances, such as the presence of moisture and the accumulation of the vegetable substance in large masses, seems to be constantly in progress; and immense tracts of peat are doubtlessly, at the present time, in process of formation. Peat is met with principally in damp marshy districts, on the borders of rivers, the course of which is impeded, so that their waters become partially stagnant; and particularly in the neighbourhood of the embouchure of great rivers, which flow through a low country. It is also encountered, in some cases, at a great height above the level of the sea,—peat bogs existing in the elevated vallies of the Alps, and also in the mountainous regions in the north-western part of South America.

In its natural state the use of peat, as fuel, is limited, both from its want of calorific power, and from its containing a large proportion of volatile matter, the odour of which is penetrating, and easily imparted to matters in its neighbourhood. When peat is, however, previously burned to charcoal, or, more properly speaking, to a kind of coke, it is converted into

a fuel of most valuable character, nearly approaching, if not quite equal to, wood charcoal, and the coke from coal, and possessing some qualities superior to either of them.

In a country where, as in England, an apparently unlimited supply of excellent fuel can always be obtained without difficulty, both for the purposes of manufacture and for domestic use, we are apt to lose sight, or to become regardless, of the advantages that may be found in the conversion of a substance like peat to a useful object; but it ought to be borne in mind, that the coal measures are probably not exhaustless; indeed, it has been publicly stated, by an unquestionable authority on such a subject, that the day when England will see the end of her coal is not so far distant as we are disposed to believe; it is therefore, even in this respect, an object of interest to see the enormous tracts of peat which cover many square miles of country, rendered available to the ends of industry, even if it were only with reference to the economising the great source of our national supremacy. With respect to the employment of peat-charcoal, there are some circumstances to be considered which serve to give it a fair title to superiority over both wood-charcoal and coke: in its application to metallurgic processes, for example, particularly in the manufacture of iron, its superiority is well marked; and in many manufacturing processes, where a continued moderate heat is requisite, this kind of fuel is very much better than either coke or wood-charcoal. The value of peat-coke, as fuel, arises from its peculiar composition; and partly from its physical character. Owing to its being somewhat friable and cavernous, it ignites readily, and, when once lighted, burns entirely away, even when in small fragments. The amount of heat it produces in burning is somewhat less than that of wood-charcoal, weight for weight; and it bears almost the same relation to coke; but it is more lasting than charcoal, and, from its chemical constitution, more suitable to metallurgic purposes than coke. Most varieties of coal contain sulphur in the form of iron pyrites, and some, sulphate of lime also, which, as well as the pyrites, is a source of sulphur, as it becomes converted into sulphuret of calcium in the process of coking. Now, in almost all metallurgic operations, the presence of sulphur is highly deleterious, as it is apt to form a combination with the metal under treatment, and so produce an injurious effect. This defect, when coke is used, attains a high pitch, unless the coke be prepared with great care and skill, so that the sulphur may be partially expelled or burned off during the process of burning: in coke prepared

in retorts, or in gas-making, the presence of the sulphur is an effective bar to its employment in the arts. The objection arising from the noxious influence of sulphur cannot certainly be urged against wood-charcoal; but this substance possesses, when compared with the coke from peat, a physical disadvantage:—from its light porous structure it burns away with great rapidity; and (although, from its purity, well suited to almost every operation in the arts) on this account it becomes too costly to be employed, excepting under circumstances in which no substitute for it can be made by coke or other fuel. At all times charcoal must be a very costly fuel, both in consequence of the limited supply of the raw material, and from the expense of manufacture. Peat-coke offers a substitute for charcoal under all circumstances, and under almost all for common coke as well. Peat seldom contains sulphur in any state; and even when that substance is present, it is in such small quantity that it is generally oxidized and expelled in the process of coking the peat.

After having been dried, peat yields, when burned, about two-thirds of its weight of coke equal to wood-charcoal; and it has been calculated that this may be produced and sold for about 35*s*.per ton; at which price it would compete, in the market, with coke from coal, and possess a great advantage in price over charcoal;—in this case, we suppose the peat-coke to be prepared according to the present method of burning charcoal, or of making coke from coal in ovens. Peat contains, however, a certain proportion of matters having commercial value, which, being volatile, are driven off during its combustion, and, consequently, lost; these are, acetic acid, ammonia, and certain volatile oils, partaking of the nature of naphtha. Seeing that these valuable matters are lost in the process of carbonizing the peat in ovens, it has been proposed to carry on the process of conversion in retorts of brick or iron, to approximate the process to the manufacture of gas from coal, or that of the extraction of acetic acid and other products from wood. This idea does not, however, with respect to peat, appear to possess much practical value; it is a question whether the quantity of the products above named be sufficient to cover the increased expense of working;—for, in the first place, the amount of peat-coke produced at each operation is reduced, inasmuch as the retorts must be limited in size; and, secondly, a great additional expense is incurred for fuel to heat the retorts, which, being closed from the air, require to be heated entirely from the outside; and, as a given quantity of peat requires the consumption of a quantity at least

equal to its own bulk, to burn it into charcoal, it is clear that one-half of the charcoal from the whole will be lost; and is to be compensated for by the volatile products collected from that peat contained within the retort;—the process being also in every way more laborious, and, consequently, more expensive. In the process of coking the peat in ovens, the peat burns itself,—the volatile matters are certainly all lost; but every ton of peat yields its proportion of coke, which is its most valuable commercial constituent.

In the manufacture of iron, it is a question whether peat-charcoal may not be entirely substituted for every other kind of fuel with striking advantage to the manufacturer, with respect both to the quantity and quality of the iron produced. It was suggested long ago by Berthier that peat might be used with advantage in the extraction of iron from its ores; and he also hinted at the advantage that might be gained by mixing the pounded ore with the charcoal, compressing the whole into the size and form of bricks, and thus placing them in the furnace;—the iron ore and carbonaceous matter would thus be brought into a degree of proximity that would probably much facilitate the reduction and fusion of the metal—at the same time that a fuel was employed incapable of producing upon the iron any injurious effect.

The employment of a fuel derived immediately from the sterile bogs which cover so many thousands of acres of land otherwise available to agriculture, would be in itself an inducement to promote the introduction of peat-charcoal into more general use; but happily the benefit would be here as much to the arts adopting the innovation as to the agents of its immediate production.

T. W. K.

ON A NEW COLORING MATTER CALLED WONGSHY.

BY M. W. STEIN, OF DRESDEN.

[Translated for the London Journal of Arts and Sciences.]

TOWARDS the close of last year a substance, bearing the name of Wongshy, was imported from Batavia into Hamburgh, with the view of being employed as a yellow dye. As no account has yet been published, relative to the application of this substance to the purpose of dyeing, the following particulars may, perhaps, prove interesting.

The new coloring matter consists of pods of seed, obtained from a plant, which, according to M. Reichenbach, belongs to the gentian family. The pods, which are *unilocular*, are of an oblong form, ovoidal, and terminating in a point on that side near the

petiol, obtuse at the opposite extremity, and surrounded by the calix, which is dry and has five divisions. They vary in size, which is generally from $1\frac{1}{3}$ to $1\frac{2}{3}$ inches in length, with a diameter (in the largest part) of about half an inch. The color is a reddish-yellow, which is not uniform; it being darker in some places than others. The surface is more or less irregular and wavy, with from six to eight longitudinal nerves. It has a smell somewhat like saffron, with an after smell of honey. The shell is hard and brittle, and on being masticated it quickly becomes mucilaginous and colors the saliva yellow, giving out a slightly bitter flavor. It swells considerably in water. Inside the pods are small seeds, of a deep reddish color, and having a rough surface; they are detached from the sides, and are closely imbedded in a hard pulp: as many as 108 of these seeds have been counted in one pod. These seeds are rather hard, being chewed with difficulty, and having no particular flavor; but leaving on the end of the tongue a peculiar burning sensation, sweet and stinging, which is similar to that of red paraguay: the pulp in which they are imbedded has a strong bitter taste, which is most perceptible at the back of the gums.

The embryo, which consists of cells, containing amylum, is surrounded with albumen; the amylum may be easily detected by means of iodine, which partially colors the embryo blue, but does not affect the mass surrounding it. On being properly prepared and viewed under the microscope, this embryo presents two cotyledons; and its structure is more particularly seen on making a transverse section of the seeds passing through the embryo. It is also to be remarked that the amorphous coloring matter, which is yellow in the cells inside the pod, with a slight tinge of green, appears of a purple red in those placed outside.

The wongshy fruits (when ground, both at the ordinary temperature, and at the boiling point) give up to water their coloring matter, which is of so divisible a nature, that two parts of the ground pods furnish 128 parts of a liquor which, on being introduced into a cylindrical vessel of white glass, $2\frac{1}{2}$ inches in diameter, displays, when exposed to the light, a clear yellow color. The concentrated extract is very mucilaginous, and is of a fire-red color, which disappears when the liquor is much diluted, and is converted into a gold-yellow. Alcohol, at 80° Centigrade, and also pure alcohol, on digesting pulverized fruit in it, also acquires a fire-red color, which is, by dilution, converted into gold-yellow. On digesting it in ether, it is, at the ordinary temperature, colored variously from pale up to brownish-yellow, and leaves, after evaporation, a thick yellowish-brown oil, which has a fruity smell and a sweet taste, slightly bitter; and which at 0° only deposits a small quantity of concrete fatty matter: on being agitated with azotate of protoxide of mercury, it does not thicken, even after a length of time; and consequently may be classed amongst the siccative oils. By saponification, perfectly colorless fatty acids

may be extracted from it. The color of this oil is therefore due to a small quantity of the coloring matter which it has carried off with it.

Fatty oils do not possess the property of extracting any portion of coloring matter from these fruits, either at the ordinary temperature, or with the addition of heat.

An aqueous solution is obtained, in the form of jelly, by the addition of alcohol. This jelly, which is of a yellowish color, may be rendered perfectly colorless by washing with alcohol. On drying, it forms a translucid mass, which is slowly dissolved by water,—forming a thick mucilage. (In one experiment made by M. Stein, in which it was extracted from a fermented solution of the coloring matter, it was not obtained in the gelatinous form, but in the form of soft flakes, which, after drying, remained white and opaque, but otherwise behaved in the same manner as the translucid substance.) This solution is not precipitated by acids; caustic soda, in excess, produces a gelatinous deposit; and when the soda is only in small quantity, the liquor remains limpid; but the addition of acid immediately produces gelatinous flakes. Carbonate of potash behaves in the same manner,—excepting that a considerable time is required for the production, by an excess of that salt, of the gelatinous thickening of the liquor, and that acids only produce slight flakes. Water of baryta precipitates the solution so completely, that the liquor from which the precipitate has been separated by filtration, on being submitted to evaporation upon a sheet of platina, and the residuum calcined, presents no traces of organic matter.—Lime water also produces an analogous precipitate, and acetate of lead produces a gelatinous precipitate.

The manner in which this substance behaves, and which has just been mentioned, agrees with the properties of pectine, as described in a recent work of M. Fremy; it will therefore be seen that wongshy contains a considerable quantity of pectine.

If, after having deprived the liquor of pectine by means of alcohol, a small quantity of acetate of copper be added, and caustic soda in excess, protoxide of copper will be precipitated. This substance, therefore, contains sugar, the presence of which is also manifested by the fact, that on exposing it in a pulverized state, and diluted with water, to a moderate heat, alcoholic fermentation will take place. During this fermentation, which, in one experiment, lasted more than three weeks, carbonic acid was disengaged in large quantity, together with, at first, an odour of beer, which afterwards changed to that of butyric and valeric acids.

On afterwards submitting the fermented liquor to distillation, a product was obtained which did not contain any alcohol, but only traces of acetic and butyric acids. In the liquor which remained, neither lactic acid nor mannite was detected. These phenomena of fermentation differ materially from those presented by what is called viscous fermentation; by which, as is known,

sugar is decomposed into carbonic acid, gum, lactic acid, and maunite, without the formation of alcohol.

A solution of gelatine produces in the aqueous extract a trace of precipitate, arising from the presence of tannin. Chloride of tin, at the ordinary temperature, does not, even after the lapse of considerable time, produce any change; but, on raising the temperature, a precipitate of a deep orange color is perceptible. Basic acetate of lead produces no change. Simple acetate of lead produces a slight cloudiness at the ordinary temperature, and an orange precipitate at the boiling point. Sulphate of iron changes the color to a deep brown-yellow, without any precipitate being formed, either in the hot or cold state. Alum,* acetate of alumina, and acetate of zinc, give yellow precipitates, but only in the hot state. Baryta water, even at the ordinary temperature, produces a yellow precipitate, which, on being boiled, turns to a reddish tint. Lime water furnishes a yellow precipitate, which is not changed by heat, Solutions of sulphate of lime and chloride of calcium give no precipitate, either in the hot or cold state. Spring water, containing a considerable quantity of carbonate of lime, did not precipitate the coloring matter, even with the addition of heat; this latter is, therefore, unable to decompose combinations of lime with acids.

With regard to the solution of the coloring matter when completely deprived of pectine, water of baryta and of lime act rather differently,—as orange precipitates are formed at the boiling point. Caustic soda, caustic ammonia, and carbonate of potash render the color darker and tinge it brown. This change is not due to the coloring matter itself, but results from the action of the alkalies upon the sugar of gelatine which is present; and also upon a very bitter and easily changed substance which could not be separated. At the same time, on boiling the liquor and employing carbonate of potash or caustic soda, the disengagement of ammonia will be perceived on testing it by holding litmus-paper over the mouth of the vessel Nitric acid, in small quantity, and at the ordinary temperature, does not produce any change in the liquor; but when this acid is added in larger quantity, it causes the red color of the liquor to disappear; which then appears limpid, although slightly tinged with red. Each drop of acid, on falling into this liquor, causes it to assume a greenish tint, giving to the matter a distant resemblance to saffron yellow, which is also turned green by nitric acid. Sulphuric acid of commerce, in the cold state, produces a brown-yellow, and in the warm it is a yellowish-green by transmission, and a deep green by reflection. After the lapse of some time, olive-

* One experiment made by M. Stein, for the purpose of ascertaining whether with alum, and by precipitating with potash, a fine lacker might not be produced, did not give satisfactory results; as by this means only a small portion of the coloring matter, combined with the alumina, was precipitated, which was entirely removed by simple washing with water.

green flakes are separated, whilst the liquor appears of a reddish-brown color. Hydrochloric acid does not produce any change in the liquor at the ordinary temperature; but, on being heated, and before reaching the boiling point, it appears of a yellow-green color by transmission and deep green by reflection. Soon afterwards deep green flakes are precipitated, and the liquor becomes of a reddish-brown color. This reaction, which distinguishes the extract of wongshy from solutions of all other known yellow coloring substances, is not caused by the pure coloring matter, but by the bitter substance above mentioned; and for this reason this test must not be employed for ascertaining whether fabrics have been dyed with wongshy, as the bitter substance does not combine with the fabric. Tartaric and citric acids change the color to a brown-red. Metallic zinc, with the addition of a few drops of hydrochloric acid, decolors the liquor, changing it to a pale yellow, which colors woollens but very slightly. The liquor does not recover its former color on exposure to the air. Sulphurous and hydrosulphuric acids only produce imperfect decoloration of the liquid;—complete decoloration is obtained with difficulty, even by the action of chlorated water.

In order to ascertain with certainty whether wongshy could be employed for dyeing, M. Stein infused a quantity of the pulverized pods in lukewarm water for twelve hours—stirring frequently; after which, the liquor was run off. In this manner the coloring matter was extracted in the most expeditious manner, without the liquor becoming too thick or viscous, by the formation of paste, which would take place at the boiling point.

With this extract, samples of woollens, properly prepared, were dyed, some without mordant, and others mordanted with alum, chloride of tin, acetate of alumina, and acetate of lead, in a bath heated to about 50° Centigrade,—as at a higher temperature the color is not pure.* The result was, that the unmordanted stuff was dyed, in a single bath, of a fine uniform orange color; and that amongst the mordanted samples, those treated with alum and acetate of alumina were better than those treated with chloride of tin; and that those having acetate of lead for a mordant, produced the least satisfactory results. The tone of the color was not changed by the three first-mentioned mordants; the samples were, however, dyed with a color less intense and less uniform. By means of a second bath, the samples treated with alum gave perfectly satisfactory results.

The coloring matter combines as readily with silk, and communicates to it a very brilliant gold color; so that M. Stein does not hesitate to give the preference to dyeing without mordants.

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* M. Stein states that, notwithstanding many experiments, he has not been able to produce a good green with wongshy yellow.

Cotton, as might have been foreseen, will only take the color by means of a mordant;—the tin mordant appearing to give the best results. The color is an orange, very agreeable to the eye. This color, whether upon wool, silk, or cotton, resists perfectly the action of soap; alkalies, however, stain it yellow; and acids and salt of tin, turn it red. From the manner in which it behaves in these cases, it differs from annotto dye, to which it, however, bears great resemblance, as will be hereafter shewn,—the similarity extending to the action of the light upon the two bodies. This color, on being exposed to the light, very soon loses its color upon cotton, and a little more slowly upon wool: in this respect it appears to be more durable upon the unmordanted samples; but when employed for silk, it offers the most resistance; so that, compared with other yellow coloring matters, it may be considered to be one of the best.

On mordanting a woollen fabric with lime water, and passing it through a boiling bath of that substance, a fine yellow, inclining to red, was obtained, which resisted completely the action of soap, and also resisted the action of light better than the orange: alkalies, acids, and salt of tin, change it less than the orange, but in an analogous manner. Various fine shades of yellow may be obtained by adding to the bath carbonate of potash or caustic potash, and passing the unmordanted pieces through the bath at the ordinary temperature. The combination of the color with the fibre takes place very speedily, and with great uniformity and tenacity. By the addition of one part of potash to 30 parts of the coloring liquor, a yellow is obtained which is of a peculiar tint, owing to the presence of a small quantity of red. By doubling the quantity of potash, a bright yellow, inclining slightly to green, is obtained.—A larger addition of potash is not desirable, as the color becomes dull and uncertain. If caustic potash be used instead of the carbonate, a pure and lively yellow will be at first obtained, and containing little less red than that produced by the carbonate; and, afterwards, a fine canary yellow, with a slight tinge of green. Ammonia acts in the same manner as carbonate of potash and caustic potash; but the color is richer in red.—The coloring matter furnishes also somewhat different tints, when the fabric, after being washed, is passed through an alkaline bath.

The action of the alkalies is the same for silk and cotton; it is, however, a little less striking, as the fibres of silk and cotton absorb the coloring matter in less quantity than wool. The manner in which the coloring matter of wongshy acts, in common with annotto dye, is explained by the chemical character of the former, which is presented as a weak acid. It is from this circumstance that it has a disposition to combine with alkalies, and even with alkaline earths, as is shewn by the precipitation by waters of baryta and lime. The combinations which it forms with the former possess a pure yellow color, and are decomposed

by the more energetic acids: when the coloring matter is thus set free, it assumes a lively cinnabar red. The matter, thus eliminated, is not the same as that which was originally in the aqueous solution, as it has become completely insoluble in water, and is only dissolved in small quantity by pure alcohol, ether, and alcohol at 80° Cent., which it colors yellow. Its color in the damp state is a cinnabar red; in a dry and most pure state, a brownish-red; and, like extract of ratanhia, it is easily reduced to powder; but, when it contains sugar and fatty matter, it presents, if inspected in thick layers, a fine yellow color; and, while in thin layers, it appears yellow and translucid, and draws humidity from the air. When the pure matter is heated on a sheet of platina, a yellow vapour is first disengaged, and the color is, in some places, pure yellow; it subsequently changes to a black, melts, and becomes carbonized. The resulting ash is very combustible;—the yellow vapours condense in yellow oily drops when the experiment is conducted in a small glass tube. Concentrated sulphuric acid brings out a faint blue, and the acid is colored with the same tint, which passes speedily to violet and brown-red; whilst the coloring matter is slowly dissolved. With water, a flaky precipitate is formed, of a dirty yellowish-grey.

The change of annotto to a blue tint by the action of sulphuric acid has no analogy with the phenomena presented by the coloring matter of wongshy, as the liquor is never, as is the case with annotto, colored a pure blue, but only presents traces of it—being violet for an instant only. It is easily soluble in ammonia and caustic soda, to which it imparts a gold color. In order to obtain it pure, an extract is made, by means of pure alcohol, from the bruised pods of wongshy; the alcohol is then separated by distillation, and the residue is treated with ether (to deprive it of the fatty matter), and afterwards dissolved in water; the solution is then treated with basic acetate of lead, with the addition of ammonia, and a precipitate is obtained. The plumbic precipitate, after being well washed and diluted with water, is afterwards decomposed by hydrosulphuric acid. On afterwards heating the liquor separated from the sulphuret of lead by the hydrochloric acid, it will be colored green; and, on evaporating it, a brown substance will be obtained, insoluble in water, and which is probably a product of the decomposition of the bitter substance above mentioned; a great part of which will, together with the fatty matter, have been carried away by the ether.* If, after

* To obtain it pure, with the etherical solution, M. Stein evaporated the ether and treated the residuum with an aqueous solution of marine salt, in order to separate the fatty matter, which was then filtered off; the liquor was then evaporated at 50 per cent., and the residuum removed by means of alcohol. On afterwards evaporating the alcohol, a brown residuum was obtained, which had no bitter taste, and was insoluble in water.

drying the sulphuret of lead, it be treated with pure alcohol, it will assume a yellow color, and give up, by evaporation,† the cinnabar red coloring matter, which is afterwards changed to brown-red. The product is, however, so small, that the quantity obtained by M. Stein did not allow of an elementary analysis being made. Nevertheless, by the help of M. Levol's method of testing, M. Stein ascertained that it did not contain any azote, neither could any traces of sulphur be detected on boiling with caustic ley.

The insolubility of the coloring matter in water, after being separated from the basic oxides, in contradistinction to its easy solubility before entering into combination with those oxides, led M. Stein to make some experiments, with the view of discovering the explanation of this phenomenon. One proof, that neither sugar nor pectine, in any way, influence the solubility of the coloring matter, is, that a solution containing sugar will, after having been boiled in caustic soda, allow the coloring matter to be precipitated, by means of vinegar; and this prepared and pure matter is neither soluble in a pure solution of pectine nor in a solution of sugar. One fact which seemed remarkable was, that the precipitation by acids took place immediately after having boiled an aqueous solution of the matter in caustic soda; while, at the ordinary temperature, a much longer time was required. M. Stein concluded from this, that the coloring matter originally existed in a state of combination, which was completely destroyed by boiling with the caustic soda. He supposes it to be an ammoniacal combination; for, as before remarked, a disengagement of ammoniacal gas was observed on boiling with caustic soda. This disengagement is, it is true, scarcely observable at the ordinary temperature; and, on the addition of chloride of platinum, even when the liquor is evaporated, no ammoniacal platinum is formed. This fact seems, therefore, to justify the opinion, that the coloring matter of wongshy is a starchy compound; and this opinion is supported by the fact, that the matter, after the solution has been boiled with caustic ammonia, cannot be precipitated by acids, but that it is capable of pecipitation from the aqueous solution, which still contains sugar, by boiling it with hydrochloric acid: in this case it should be remarked, that it is not of a cinnabar red color, but a brown-yellow, by reason of the products of decomposition of the sugar which were present.

M. Stein observes, in conclusion, that wongshy contains 5 per cent. of ash, which is obtained at a low temperature, and in an entire state, by mixing the pounded fruit with powdered platina.

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† M. Stein remarked, in one instance, in the solution, concentrated by evaporation by the aid of a magnifying glass, detached white crystals, and others in the form of needles, in the midst of the amorphous mass of coloring matter.

It was observed, in some experiments (in which platina was not employed), that, at a certain temperature, there was, each time, sudden and violent combustion, which led to the belief that the fruit, perhaps, contained saltpetre. M. Stein, therefore, treated the fruit (deprived as much as possible of coloring matter by means of alcohol) with water, and endeavoured to detect the presence of nitric acid in the extract by means of sulphate of iron; he also treated another portion with sulphuric acid, but no traces were perceptible.

The ash of wongshy rapidly absorbs humidity from the air, and effervesces briskly with acids. On saturating it with nitric acid, M. Stein determined the proportion of phosphoric acid which it contains, according to M. H. Rose's process; *i.e.*, by the help of mercury, and other ingredients usually employed.

100 parts of ash contain—

Phosphoric acid - - -	10·27	= 5·75 O
Silica - - - -	4·00	
Sulphuric acid - - -	0·93	
Chlorine - - - -	0·55	
Lime - - - -	11·96	= 3·36 O
Magnesia - - - -	3·47	
Oxide of iron - - - -	5·51	
Soda - - - -	11·35	
Potash - - - -	29·19	
	77·23	

The solution of this ash, neutralized by nitric acid, is precipitated of a fine yellow color, by nitrate of silver; and the proportion of oxygen contained in the lime, bears the same proportion to that in the phosphoric acid as that contained in the basic phosphate of lime, according to the formula $CaO \times PO_5$. The question, whether these two matters are really thus combined, is left undecided,—M. H. Rose having perfectly demonstrated, in a recent work, how little one is justified in pronouncing upon the state of combination of the inorganic elements of plants from the analysis of their ash. The greater part of the basic oxide above mentioned must be combined with an organic acid, as it is found in the ash combined with carbonic acid. The quantity amounts to 21·67 per cent., supposing the alkalies to be in the state of carbonates, and the loss of 1·10 per cent. observed, to be really owing to the carbonic acid combined with the magnesia; which acid, on incineration in the presence of the alkaline carbonates, is but imperfectly driven off from the magnesia.

ON A NEW METHOD OF GILDING PORCELAIN.

BY M. GRENON.

M. GRENON, decorator of porcelain, of Rue de Faubourg, St. Martin, Paris, submitted to the Society for the Encouragement of National Industry, Paris, an improvement in gilding porcelain, which adds much to its durability.

The operation of gilding, as generally practised, consists, as is well known, in mixing with the preparation of gold and proto-nitrate of mercury, a certain quantity of subnitrate of bismuth which serves as a flux, and allows the metal to be burnt into the porcelain. The gold prepared by nitrate of mercury, may be applied in extremely thin layers, so that this process will be very economical; it is, however, not very durable. Gold, obtained by sulphate of protoxide of iron, furnishes a more solid, although less economic gilding. Different processes have been employed for rendering gilding more durable without increasing the expense.

M. Rousseau's method is, first to lay a coating of platina, mixed with flux, and then a thin coating of gold upon the platina. This gives a solid gilding, but it is apt to lose its lustre by use,—the color of the gold being modified by that of the platina, which appears when the gold wears away.

M. Grenon's process consists in the successive application of two layers of gold, each having a special flux, and in different proportions. The first layer is first burnt in at a high temperature; after which, it is polished with rotten-stone, and on it is laid a thin coating of mercury-gold, which is prepared and burnt in the ordinary manner. This gilding is easily burnished, and takes a fine polish; and it has been proved that friction from hard bodies, which would seriously injure ordinary gilding, does not affect it.

M. Grenon's method merits attention from the public on account of its solidity and brilliancy; the increase in price (which is not very considerable) being justified by the quantity of gold employed, and the double expenses of laying-on and burning.

TRANSACTIONS OF THE SOCIETY OF ARTS.

APRIL 17TH, 1850.

ON this evening (which was the first meeting for reading and discussing papers on science and art since February 13th) a paper was submitted to the Society by Mr. ANTOINE CLAUDET,—

On the properties of the diamond for cutting glass, with descriptions of machines invented by him in which the diamond is made to perform perfectly what by manual labour had before been very imperfectly done.

The author commenced his paper by a very interesting description of the nature of the diamond, of the form of its natural

crystal, and of the mode in which it cuts glass (which was stated to be by an action similar to that of the wedge—the fissure made by the diamond extending in depth beyond the cutting point); and he likewise gave a history of the use of glass in windows from the earliest times, when it was used only in ecclesiastical buildings of great splendour, down to its present universal application. In order the more thoroughly to make apparent the advantage of the use of the diamond, he described minutely the very tedious and imperfect methods by which, before its introduction, glass was cut and shaped. The property in question was first found out about the time of Francis I. of France; and the different tools used from that time to the present for its manual application were detailed and commented on,—many of them being exhibited by the author. The first of these was a mere handle, having the diamond firmly inserted into the lower end; but the handle being round, and the diamond, from the form of its crystal, requiring one unvarying direction to be preserved, in order to produce a cut, this was found so imperfect, that a step was taken by making the end of the handle flat, to preserve the parallelism against the rule. This, from the shape of the bottom in which the stone was set, was called the "plough diamond." In 1814, Shaw, of London, made a great improvement, and brought the instrument to the shape in which it is still used, by making the metallic setting of the diamond moveable on a ferrule at the bottom of the handle;—thus putting it out of the power of any deviation of the hand from the proper position to affect the direction of the stone. This, perfect as it may seem, is still difficult to use, and requires long practice for expert performance. The two tests by which the workman knows when his tool is "making a cut," are—the sound and the feel. A modification of the last-named tool was made by the brother of its inventor for those who have but little practice; but it was very little used; and the one shewn to the meeting by Mr. Claudet was curious, from being, perhaps, the only one now in existence.

The paper briefly described the process of making sheet-glass, as follows:—The tube which served as the blow-pipe was dipped into the molten metal, and a bulb was blown, which was elongated into a cylindrical form by a jerking action. This, after cooling, was cut by a diamond in a direction parallel to the axis; and, the cut cylinder was placed in what is termed the "flattening furnace," where the glass softened, and gradually fell into an extended sheet. This was esteemed a preferable mode of obtaining a large square surface of glass than by the crown-glass method, in which the square had to be cut from a larger circle.

The cause of the invention of the machines, the description of which was the principal object of the paper, was the increased use of glass shades for covering ornaments, the cutting of which,

so that they should stand perfectly firm and with an even base, was a most tedious and imperfect operation when done by hand;—the workman rolling the shade along a table, and pressing it constantly at the successive points of contact with the diamond.

The manufacture of these shades (which, under the name of *cylindres de verre*, had long been carried on in France) was first undertaken in England, at the instance of Mr. Claudet, by Mr. Lucas Chance, of Birmingham, who, notwithstanding the vexatious pressure of the excise laws, now repealed, embarked largely in the manufacture,—getting workmen from France, for making both shades and the sheet-glass which had there been for some time made from cylinders. It was now, however, found, that some method of cutting the bottom of the shades and cylinders must be adopted surer and less expensive than the manual method; and Mr. Claudet was driven by this necessity to invent his machines.

The principal of them, and that most universal in its application, may be thus described:—Over a horizontal table a level bar is suspended, at any height above it, by means of screws confining it in two upright grooves; and in the centre of the table an upright rod, also susceptible of adjustment, is placed, terminating in a small cross bar, which moves about a universal joint, and has at each of its ends two small bars, turning on a pivot, each of which is supplied at either end with a small wheel, covered with cork. When the cross bar is adjusted nearly to the height above the table at which the shade ought to stand when ready for cutting, the shade is placed upon it, and rests upon the four small rollers already described;—the bottom of the shade being a few inches above the table. The outside bar is then brought down, and presses it externally with two semicircles of cork, which are attached to the lower surface of the bar. A looking-glass enables the operator, who is seated before the machine, to determine when the shade is exactly upright in all situations; and this position being attained, the cutting is performed by means of an instrument quite distinct from the rest of the apparatus. The cutting instrument consists of a small, but heavy, metallic case, mounted on three spherical castors, and carrying an upright rod, at the extremity of which the cutting diamond is fixed in a horizontal position. A second rod, terminating with two small wheels, covered with cork, which come into juxtaposition with the diamond, turns upon a pivot connected with the principal stem of the instrument; and the wheels are pressed towards the diamond by means of a spring, acting between the rods, below the pivot. The shade, when finally adjusted in its position, being made steady by a small elastic rod coming from one of the upright grooves, is ready to be cut; and, for that purpose, the instrument in which the diamond is inserted is brought underneath it, and the edge of the glass brought between the diamond and the

wheels,—the diamond being situated about an inch above the bottom of the shade. By the contact thus produced, and the heavy base of the cutting instrument being carried round the shade, the diamond makes a clear horizontal cut, and a strip of glass is taken from the shade, which then stands quite evenly on the section,

The shape of the shade, whether oval, round, or square, is unimportant in the use of this machine; but Mr. Claudet has contrived another for cutting round shades only, in which the shade is laid horizontally on four small cork-covered wheels, which are geometrically adjusted, according to the diameter of the glass; so that the diamond, which is fixed, for glasses of all sizes, at an angle of 45° to the horizon, will, when the adjustment is made, be perpendicular to the surface of the shade at the point of contact. By turning the shade about its axis, a clean cut is made, which returns into itself, and is continuous, because the convex extremity of the glass rests constantly against an upright board. When the glass shade is conical, the fixing of the diamond is adjusted by an arrangement as simple as it is perfect. Instead of being rigidly fixed to the upright rod, it is rigidly fixed at right angles to a smaller one, which turns upon a pivot connected with the upright rod, and carries at its other extremity a small wheel, the radius of which is equal to the perpendicular distance of the point of the diamond from the small bar. It will be readily perceived that this adjustment will keep the diamond constantly perpendicular to the surface of the glass. M. Claudet's horizontal apparatus will also cut glass tubes large enough to admit a diamond, and is vastly superior to the practice of scratching by a file.

APRIL 24TH, 1850.

A paper from MR. J. PYM, *was read,—having for its subject the means of supplying the metropolis with pure water and in ample quantity.*

The author commenced by stating that the water supply of the metropolis is derived from three sources:—the New River, the Thames, and the Lea; wells sunk to different depths in the London clay, sand, and gravel; and Artesian wells. Of the water thus obtained, that from the Thames is impure, that of the New River almost as bad for a great part of the year,—whilst many of the wells, being impregnated by drainage from burial-grounds or sewers, yield water of a decidedly pernicious quality. Artesian wells, that is, wells sunk through the London clay into the chalk, produce excellent water; but only of limited quantity,—the supply failing in dry weather, and being seriously affected if a deeper well be sunk in the neighbourhood: indeed, it appears certain, that if all the water lying in the chalk of the London basin could

be brought to the surface, it would fall short in quantity of that required. The question which the author proposes is, how to obtain a sufficient supply through the medium of these wells; and his plan is as follows:—At a given distance from the Thames, on each side thereof, to sink down to the chalk a series of shafts, and form a short canal from the mouth of each shaft to the bank of the river, at such a level that when the tide is at a given height the water will flow into the shafts; whereby an immense supply would, twice a day, be given to the chalk basin. Other shafts are to be sunk at small distances from the former ones, up which the filtered water would rise, as into inverted syphons, till near the level of the Thames; and from these ascending shafts it should be distributed by steam-power. By this plan, the chalk stratum of the London Basin, extending from Highgate to Forest Hill, would be converted into a large filter. A shaft of the diameter of those of the Thames Tunnel would probably filter a quantity of water equal to that supplied by the New River. The shafts might be converted into preparatory filter beds by filling them with sand and gravel. The author considers that the water being thus quickly filtered through the chalk, would not become so impregnated with lime as the water usually got from Artesian wells, which has lain in it for a length of time. This plan would allow of the existing mains, pipes, &c., of the water companies being used as before.

The author stated, as an example of the absorbing properties of the chalk, that farmers, on or near the outcrop of the chalk, frequently sunk shallow wells, which served as drains and removed a large portion of useless surface water.

Mr. Varley stated that Mr. Sharp sunk an Artesian well near the Thames, and the height of the water in that well varied with the height of the Thames at high and low tides [from which it was inferred that a natural communication existed between the Thames and some part of the chalk basin]. He considered Mr. Pym's plan to be ingenious; but thought that unless the organic matters contained in the Thames water were separated therefrom before it entered the shafts, the water, filtering through the filter beds, would ultimately corrupt the whole of the chalk basin. To prove that clearness was not an absolute test of purity, he said that he had drawn Thames water from a cistern in a perfectly limpid state; but that after standing four or five days it became putrid; whereas, by boiling some of the water from the same cistern, he was enabled to keep it sweet for some years.

Mr. Giles said that the water from the Artesian wells contains three times the amount of chemical impurities of any of the waters from the streams around London: the water of the Lea contains twelve grains of lime to the gallon; but the water from Artesian wells, in addition to lime, contains sulphate and muriate of soda,

&c. He considered that if some plan were adopted for preventing the contents of the sewers from entering the Thames, then as pure water as could be desired might be obtained therefrom. He doubted the efficacy of Mr. Pym's plan, and asked—Why, as the Thames flows over the chalk at Pangbourne and Henley, it does not fill the chalk basin? He thought that the chalk basin could not be made to filter water in sufficient quantity to equal the demands of the metropolis.

On the purification of coal-gas,—by Mr. Laming.

At the conclusion of Mr. Pym's communication a paper was read on the above subject, giving some details of Mr. Laming's patent process, whereby he has succeeded in effecting the complete purification of coal-gas, by the chemical action of its own impurities on materials which do not require to be periodically renewed. The peculiar feature of the invention is, to cause the sulphur in the gas to become spontaneously converted into sulphuric acid, and then to combine with the next greatest impurity, viz., the ammonia, and form sulphate of ammonia—which is a solid and inodorous salt of considerable value. The carbonic acid of the gas, which is mainly instrumental in bringing about these chemical changes, escapes after having done its office, and is got rid of without expense. The author of the paper commenced by observing, that it was surprising that the perfect purification of gas, so important both in a sanitary and commercial point of view, should have excited so little interest in persons capable of investigating the subject; and that now, after nearly half a century, the problem remains as far from a satisfactory solution as ever. That the primitive and palpably imperfect purification by lime should be still universally prevalent, may appear blameworthy on the part of the officers to whom public companies have entrusted the internal arrangement of their works; but when the extent and diversity of the duties of a gas engineer and the purely chemical character of gas-making are taken into consideration, it rather excites surprise that the Directors have not seen it prudent to aid their engineers by appointing competent and intelligent chemists to assist them. The author then alluded to inventions calculated to aid the lime in its purifying powers, and remarked, that none of them pretended to be able to supersede the use of lime altogether. In using lime, the loss of material is so great, that not more than 33 per cent. of the quantity employed is really effective; it removes very little of the ammonia; and its odour, when taken from the purifying vessels, is universally known to be detestable. The process of Mr. Laming has been tried in Paris, and successfully carried out in the Chartered Company's Works, at Westminster,—first, on a production of about 7000 cubic feet of gas per hour, and subsequently in purifiers

ten feet square. The purifying material virtually consists of a mixture of the two oxides of iron and calcium, which the author sometimes makes by decomposing a saturated solution of muriate of iron by lime or chalk, and then mixing in breeze or saw-dust, to give to the mass the necessary permeability. This material withdraws from the gas 22 parts of carbonic acid for every 17 parts of ammonia which it removes, besides the sulphuretted hydrogen: the perfection of its action is such, that the gas which has passed throught it does not afford the slightes trace, either of ammonia or sulphuretted hydrogen, to the most delicate tests.

While the mixture is being made, the iron becomes peroxidized by the atmosphere,—a result which is greatly facilitated by its spontaneously elevated temperature, as well as by the porosity of the mass. The affinities called into play on passing impure coal-gas through this very pervious material, placed, instead of lime, in the ordinary lime purifiers, are as follows:—The impurities are dissolved in the moisture of the absorbent matter, which is forcibly retained by the hygrometric nature of the muriate of lime also dissolved in it. The sulphuretted hydrogen then combines with the peroxide, to form water and sesqui-sulphuret of iron. The ammonia, at the same time, is attacked by the carbonic acid, giving up in exchange the sulphuretted hydrogen, with which it is in part combined; while, in proportion as the ammonia and carbonic acid unite to form carbonate of ammonia, the latter salt reacts on the muriate of lime, with production of muriate of ammonia and carbonate of lime. When none of the oxide of iron and muriate of lime remains unchanged, the vessel which contains the materials is thrown for a time out of connection, and the materials are exposed to atmospheric air—by which their purifying powers become regenerated. The affinities in this regeneration are as interesting as those concerned in the gas purification. The oxygen of the air changes the sesqui-sulphuret of iron into a sulphate of iron; and this salt, and the carbonate of lime, reciprocally decompose each other,—forming sulphate of lime and carbonate of oxide of iron; but, as artificial carbonate of iron is not persistent in the presence of atmospheric oxygen, it becomes quickly changed into hydrated peroxide of iron,—the carbonic acid escaping into the air.

These changes, brought about by the action of the atmosphere, reproduce the purifying material in its pristine energy, with this difference—that, as the process began with muriate of lime, combined with the oxide of iron, the process is continued by that oxide mixed with precipitated sulphate of lime, which acts on the carbonate of ammonia in precisely the same way as the muriate of the same base. The regeneration of the used materials is completed in an hour or two, and the author has already effected it as many as fifteen times: there seems, in fact, to be no end to it: but undoubtedly a time must arrive when the accumulated salt of

ammonia will need to be washed out; and, when this has been done, the material will be again in all its pristine force.

The advantages of this new process are, that the gas is completely purified, even from its sulphuret of carbon, the most intractable of all its impurities (and that with an increase in illuminating power which has been estimated as at least 8 per cent.); the materials are inexpensive and susceptible of repeated use an indefinite number of times, with little labour; they give no unpleasant odour when done with; convert the impurities of the gas into marketable products of value; and the wear, tear, and cost of apparatus, generally an important item, is reduced to a minimum.

Liebig conceives that peroxide of iron is the purifying agent of the human blood,—absorbing oxygen in the lungs, and passing as arterial blood to the various parts of the system, where it combines with organic matter and evolves heat, with the production of carbonate of oxide of iron; in which state it returns as venous blood to the lungs, and is then decomposed, with evolution of carbonic acid and re-formation of peroxide of iron; and so on, as before. If this be correct, the resemblance of the two processes is curious and interesting.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Mar. 22. *William Wolfe Bonney*, of Claremont Villa, St. John's, Fulham, for a safety boat.

27. *W. Kidston & Co.*, of Bishopsgate-street, London, for a double-action pump.

27. *Alexander Grant & Brother*, of Clement's-court, Wood-street, London, for the "fleur-de-lis parasol."

30. *William Robertson*, of Glasgow, civil engineer, for a mineral discharger.

30. *Thomas Dean*, of Wishaw, tile-maker, and *Robart Thorburn*, of Broxburn, engineer, for a drain-tile cutting apparatus.

30. *The Ainslie Brick & Tile Machine Company*, of 193A, Piccadilly, London, for a pipe socket-mould pallet and cutter.

30. *Frederick Parker*, of Boston, Lincolnshire, for a signal apparatus.

30. *William Harding*, of 503, New Oxford-street, London, for the "Arden clasp."

Apr. 2. *Frederick Wilson*, of Leeds, Yorkshire, for a weighting and driving apparatus, to be applied to the rollers of wool-washing, calendering, and other machines of similar construction.

Apr. 2. *Thomas Day & Christopher Martin*, of Birmingham, for a rotatory heel for boots and shoes.

3. *Thomas Waddington*, of Derby-street, Cheetham Hill-road, Manchester, for the "paragon neck-tie."

3. *Samuel Last*, of 256, Oxford-street, and 165, New Bond-street, trunk and portmanteau manufacturer, for the "tient-tout, or railway portmanteau."

3. *Wellington Williams*, of Gutter-lane, for a fastening and band for shirt collars.

4. *W. H. Martin*, of 64, Burlington Arcade, for the "Pagetina parasol riding-whip."

5. *Batters, Clements, & Morton*, of St. John's Wharf, Millbank-street, Westminster, coal merchant, for the "wagon weighing-machine."

5. *Robert Gordon & Co.*, of Heaton Foundry, Stockport, for an improved steam-boiler.

8. *William Murray*, of University-street, London, for a self-cleansing tubular filter.

8. *John Mather*, of Beaufort-street, Chelsea, for an improved bath-valve.

8. *A. Beldham & Co.*, of Portsea-court, tailors and outfitters, for a self-supporting waistband.

9. *Joseph Welch & John Margetson*, of 17, Cheapside, London, for the "Clarendon cravat."

10. *John Gouger*, of 68, Wood-street, Cheapside, for the "nonpareil collar."

13. *James Seddon & James Eckersley*, of Little Bolton, in the county of Lancaster, for a cop-dryer.

13. *John Porter Abbott, Samuel Wright Wade, & Robert Walshaw*, of Bamber-street, Liverpool, chronometer and watch-makers, for a dead-beat pocket or a marine chronometer.

15. *John Hendry*, of 31, Gifford-street, Kingsland-road, and *James Murphy*, of Honduras-street, Old-street, St. Luke's, for a refrigerator.

15. *Louise Smallwood*, of 14, Rue des Chateux, Dunkerque, for an improved tile.

16. *Scowen & White*, of 9, Noble-street, Cheapside, London, for the "Aptandum collar."

17. *Francis Herbert Wenham*, of Effra Vale Lodge, Brixton, in the county of Surrey, engineer, for a parabolic reflector for illuminating transparent objects for a microscope.

17. *George Kelly Matthews*, of Charing-cross, London, for a pneumo-monitor.

18. *George Frederick Hipkins*, of 203, High-street, Ashted, Birmingham, for an improved nutcracker.

Apr. 18. *Richard Edwards*, of Fairfield-place, Bow, Middlesex, for a knife-cleaning apparatus.

19. *A. Marshall & Co.*, of 4, Park-side, Hyde-park-corner, for part of the apparatus used in corsets, denominated the "corset à tous resorts."

20. *J. Robertson*, of Emmett-street, Poplar, for apparatus for giving signals by sound.

20. *Mary Ann Nash*, of Paul's Cray Mill, Kent, for an impressing surface of a dandy-roller, for producing water-marks on machine-made paper.

20. *John Weems*, of Johnstone, Renfrewshire, tin-smith, and *Thomas Buchanan*, of the Bridge of Weir, Renfrewshire, for an improved cover for carding and drawing-frame cans, applicable to cotton, flax, and woollen factories.

20. *Alfred Gregory*, of 54, St. George's-street, St. George's East, London, for a safety-plate for a ship's scuttle.

20. *Henry Potts*, of 18, Brooke-street, Holborn, for a postage-stamp damper and affixer.

22. *Reeves, Greaves, & Reeves*, of Birmingham, for a sword-tang.

22. *William Horne*, of Long Acre, Middlesex, carriage-builder, for an improved barouche or barouche-phaeton.

23. *Robert Waddell*, of Liverpool, engineer, for a capstan.

23. *Crosse & Blackwell*, of Soho-square, for a stopper for glass and earthenware bottles and jars.

23. *Thomas Kerslake*, of Exeter, for an improved boiler and furnace.

24. *William Alexander Adams*, of Midland Works, Smethwick, Staffordshire, for a carriage-spring and centre clip.

24. *Nicholas Downing*, of the Phœnix Foundry, Shildon, for a cast-iron railway carriage-wheel.

25. *John Finlay*, of Glasgow, ironmonger, for a radiating register stove.

26. *James Cuthbert & Co.*, of Great Distaff-lane, in the City of London, wine merchants, for an apparatus for mulling liquids.

27. *Charles Starkey*, of Bloxwich, for a lock.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th March to the 17th April, 1850, inclusive.

To John Fowler, Jun., of Melksham, in the county of Wilts, engineer, for improvements in draining land.—Sealed 17th April.

List of Patents

Granted for SCOTLAND, subsequent to March 22nd, 1850.

To François Vouillon, of Princes-street, Hanover-square, in the county of Middlesex, manufacturer, for improvements in the manufacture of hats, caps, bonnets, and other articles, made of the same or similar materials.—Sealed 26th March.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, civil engineer, for improvements in the manufacture of knobs for doors, articles of furniture, or other purposes; and in connecting metallic attachments to articles made of glass or other analogous materials,—being a communication.—Sealed 26th March.

Jonathan Charles Goodall, of Great College-street, Camden-town, London, card-maker, for improvements in machinery for cutting paper.—Sealed 27th March.

Charles Felton Kirkman, of Argyle-street, London, for improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances.—Sealed 28th March.

Robert Milligan, of Harden, near Bingley, Yorkshire, manufacturer, for an improved mode of treating certain floated warp or weft, or both, for the purpose of producing ornamental fabrics. —Sealed 28th March.

Robert White, and James Henderson Grant, both of Dalmarnock-road, Glasgow, engineers, for certain improvements in machinery or apparatus to be used in mines; which improvements, or parts thereof, are also applicable to other purposes of a similar nature.—Sealed 11th April.

William Mac Lardy, of Manchester, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.—Sealed 15th April.

John Scoffern, of Essex-street, London, M. B., for improvements in the manufacture and refining of sugar; and in the treatment and use of matters obtained in such manufacture; and in the construction of valves used in such and other manufacture.—Sealed 17th April.

James Buck Wilson, of St. Helens, in the county of Lancaster, rope-maker, for certain improvements in wire ropes.—Sealed 22nd April.

New Patents

SEALED IN ENGLAND.

1850.

Thomas Walker, of Wednesbury, in the county of Stafford, iron-master, for improvements in the manufacture of sheets or plates of iron for certain purposes. Sealed 28th March—6 months for inrolment.

James Samuel, of Willoughby House, in the county of Middlesex, civil engineer, for certain improvements in the construction of railways and steam-engines, and in steam-engine machinery. Sealed 5th April—6 months for inrolment.

Joseph Findlay, of Paisley, in the county of Renfrew, North Britain, manufacturer, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances. Sealed 5th April—6 months for inrolment.

To George Henry Phipps, of Park-road, Stockwell, in the county of Surrey, engineer, for improvements in propelling vessels. Sealed 5th April—6 months for inrolment.

Jonathan Charles Goodall, of Great College-street, Camden-town, in the county of Middlesex, card maker, for improvements in machinery for cutting paper. Sealed 5th April—6 months for inrolment.

Charles Seely, of Heighington, in the county of Lincoln, merchant, for improvements in grinding wheat and other grain. Sealed 5th April—6 months for inrolment.

John Platt, of Oldham, in the county of Lancaster, engineer, for certain improvements in machinery or apparatus for spinning, doubling, and weaving cotton, flax, and other fibrous substances. Sealed 11th April—6 months for inrolment.

Richard Prosser, of Birmingham, in the county of Warwick, civil engineer, for certain improvements in machinery and apparatus for manufacturing metal tubes; which improvements in machinery are in part applicable for other purposes, where pressure is required: also for improvements in the mode of applying metal tubes in steam-boilers or other vessels requiring metal tubes to be applied within them. Sealed 11th April—6 months for inrolment.

Amedée François Remond, of Birmingham, for improvements in the manufacture of envelopes.—Sealed 15th April—6 months for inrolment.

Edme Augustin Chameroy, of Paris, for improvements in the manufacture of boilers, and of pipes of malleable substances, as well as of elastic matter. Sealed 15th April—6 months for inrolment.

Robert Reid, of Glasgow, manufacturer, for certain improvements in weaving. Sealed 15th April—6 months for inrolment.

Floride Heindryckx, of Brussels, engineer, for improvements in propelling. Sealed 15th April—6 months for inrolment.

Cuthbert Dinsdale, of Newcastle-upon-Tyne, dentist, for improvements in the manufacture of artificial palates and gums, and in the mode of setting or fixing natural and artificial teeth. Sealed 15th April—6 months for inrolment.

John Turner, of Birmingham, engineer, and Joseph Hardwick, of the same place, for a certain improvement or certain im-

provements in the construction and setting of steam-boilers. Sealed 15th April—6 months for inrolment.

George Attwood, of Birmingham, copper roller manufacturer, for a new or improved method of making tubing of copper or alloys of copper. Sealed 15th April—6 months for inrolment.

Charles de Bergue, of Arthur-street West, London, engineer, for certain improvements in locomotive and other steam-engines; also in buffers, for railway purposes. Sealed 15th April—6 months for inrolment.

John Dove Harris, of the borough of Leicester, manufacturer, for improvements in the manufacture of looped fabrics. Sealed 18th April—6 months for inrolment.

William Buckwell, of the Artificial Granite Works, Battersea civil engineer, and George Fisher, of the Taff Vale Railway, Cardiff, civil engineer, for improvements in the construction and means of applying carriage and certain other springs. Sealed 18th April—6 months for inrolment.

William Henry Ashurst, of the Old Jewry, in the City of London, Gent., for improvements in the manufacture of varnishes,—being a communication. Sealed 18th April—6 months for inrolment.

Thomas Ross, of Coleman-street, in the City of London, Gent., for improvements in machinery for raising a pile upon woven and felted fabrics. Sealed 18th April—6 months for inrolment.

Abraham Moses Marbe, of Birmingham, chemist, for an improved manufacture of vegetable fluid to be used in the production of artificial light; and in lamps or burners for consuming the same; which vegetable fluid is also applicable to the manufacture of lacker or varnish. Sealed 18th April—6 months for inrolment.

William Hargreaves, the younger, of Bradford, in the county of York, iron-founder and whitesmith, for certain improvements in the means of consuming smoke; parts of which improvements are also applicable to the generating of steam. Sealed 18th April—6 months for inrolment.

Peter Arkell, of Chapel-street, Stockwell, Surrey, engineer, for improvements in the manufacture of candle-wicks. Sealed 20th April—6 months for inrolment.

Alfred George Anderson, of Great Suffolk-street, Southwark, Surrey, soap manufacturer, for improvements in the treatment of a substance produced in soap-making; and its application to useful purposes. Sealed 20th April—6 months for inrolment.

John Timothy Chapman, of Wapping, Middlesex, engineer, for improvements in apparatus for setting up ships' rigging, and raising weights. Sealed 20th April—6 months for inrolment.

Richard Archibald Brooman, of Fleet-street, London, for improvements in the manufacture of zinc; and in the apparatus employed therein. Sealed 20th April—6 months for inrolment.

William Henry Ritchie, of Brixton, Surrey, for improvements in the manufacture of copper, brass, and other tubes or pipes. Sealed 23rd April—6 months for inrolment.

William Mc Alpin, of Spring Vale, Hammersmith, general dresser, and Thomas Mc Alpin, of the same place, manager, for improvements in machinery for washing cotton, linen, and other fabrics. Sealed 23rd April—6 months for inrolment.

Charles Humfrey, of Downing College, Cambridge, M.A., for improvements in the manufacture of candles and oils; and in treating fatty and oily matters; and in the application of certain products of fatty and oily matters. Sealed 23rd April—6 months for inrolment.

Antoine Pauwels, of Paris, France, merchant, and Vincent Dubochet, also of Paris, France, merchant, for certain improvements in the production of coke, and of gas for illumination; and also in regulating the circulation of such gas. Sealed 23rd April—6 months for inrolment.

Richard Laming, of the New Chemical Works, Isle of Dogs, Middlesex, chemist, and Frederick John Evans, of the Horseferry-road, Westminster, gas-engineer, for improvements in the manufacture of gas for illumination, and other purposes to which coal-gas is applicable; in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas; also improvements in treating certain products resulting from the distillation of coal; parts of which above-mentioned improvements are applicable to other similar purposes. Sealed 23rd April—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, Middlesex, civil engineer, for improvements in casting type,—being a communication. Sealed 23rd April—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for certain improvements in the manufacture of wafers; and in the machinery or apparatus connected therewith,—being a communication. Sealed 23rd April—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for a new and improved mode of conducting, consuming, and disengaging smoke from its deleterious compounds,—being a communication. Sealed 23rd April—6 months for inrolment.

Ernest Werner Siemens, of Berlin, Prussia, electric engineer, for improvements in electric telegraphs. Sealed 23rd April—6 months for inrolment.

Joseph Jean Baranowski, of London, Gent., for improvements in machinery for counting, numbering, and labelling. Sealed 23rd April—6 months for inrolment.

CELESTIAL PHENOMENA FOR MAY, 1850.

D.	H.	M.	
1			Clock after the ☉ 3m. 3s.
	—		☽ rises Morn.
	—		☽ passes mer. 3h. 44m. M.
	—		☽ sets 8h. 2m. M.
	11	35	♃'s first sat. will em.
2	3	30	☿ in conj. with ♀ diff. of dec. 1. 49. N.
	12	0	☽ in Apogee
3	9	9	♃'s second sat. will em.
4	10	46	☽ in □ or last quarter
5			Clock after the ☉ 3m. 29s.
	—		☽ rises 2h. 3m. M.
	—		☽ passes mer. 6h. 53m. M.
	—		☽ sets 11h. 50m. M.
	9	45	♃'s third sat. will em.
	15	35	☿ greatest hel. lat. N.
8	12		♂ in conj. with Vesta, diff. of dec. 2. 11. N.
	13	29	♃'s first sat. will em.
	20	30	♄ in conj. with the ☽ diff. of dec. 2. 2. N.
9	16	38	♅ in conj. with the ☽ diff. of dec. 4. 22. N.
10			Clock after the ☉ 3m. 49s.
	—		☽ rises 4h. 6m. M.
	—		☽ passes mer. 10h. 45m. M.
	—		☽ sets 5h. 38m. A.
	4	20	♃ stationery
	11	46	♃'s second sat. will em.
11	11	9	Ecliptic conj. or ● new moon
12	10	36	♃'s third sat. will em.
12	18	6	♀ in conj. with the ☽ diff. of dec. 5. 17. N.
13	0	16	☿ in conj. with the ☽ diff. of dec. 7. 4. N.
	18	28	♂ in Aphelion
	—		Mercury R. A. 4h. 49m. dec. 24. 55. N.
	—		Venus R. A. 4h. 35m. dec. 22. 35. N.
	—		Mars R. A. 8h. 6m. dec. 22. 0. N.
	—		Vesta R. A. 8h. 2m. dec. 24. 27. N.
	—		Juno R. A. 12h. 58m. dec. 4. 16. N.
	—		Pallas R. A. 21h. 55m. dec. 10. 29. N
	—		Ceres R. A. 23h. 50m. dec. 10. 55. S.
	—		Jupiter R. A. 10h. 59m. dec. 7. 54. N.

D.	H.	M.	
13			Saturn R. A. 1h. 2m. dec. 4. 11. N.
	—		Georg. R. A. 1h. 44m. dec. 10. 11. N.
	—		Mercury passes mer. 1h. 25m.
	—		Venus passes mer. 1h. 11m.
	—		Mars passes mer. 4h. 42m.
	—		Jupiter passes mer. 7h. 35m.
	—		Saturn passes mer. 21h. 35m.
	—		Georg. passes mer. 22h. 17m.
14	8		☽ in Perigee
15			Clock after the ☉ 3m. 55s.
	—		☽ rises 7h. 24m. M.
	—		☽ passes mer. 3h. 29m. A.
	—		☽ sets 11h. 31m. A.
16			Occul. d^2 Cancri, im. 10h. 11m. em. 11h. 2m.
17	9	53	♃'s first sat. will em.
18			Occul. *a* Leonis, im. 3h. 11m. em. 4h. 8m.
	3	52	☽ in □ or first quarter.
19	7		♃ in conj. with the ☽ diff. of dec. 0. 49. S.
	—		Occul. JUPITER, im. 6h. 32m. em. 7h. 37m.
	—		Occul. *a* Leonis, im. 13h. 42m. em. 14h. 11m.
20			Clock after the ☉ 3m. 47s.
	—		☽ rises 1h. 25m. A.
	—		☽ passes mer. 8h. 2m. A.
	—		☽ sets 2h. 1m. M.
22	3	17	☿ in conj. with ♀ diff. of dec. 0. 38. N.
24	11	47	♃'s first sat. will em.
25			Clock after the ☉ 3m. 25s.
	—		☽ rises 7h. 17m. M.
	—		☽ passes mer. 12h. 0m. A.
	—		☽ sets 4h. 6m. M.
26	0	8	Ecliptic oppo. or ○ full moon
28	15	46	Pallas in □ with the ☉
	18	46	☿ stationary
	—		Occul. x^1 Sagittarii, im. 11h. 49m. em. 13h. 10m.
29			Occul. *f* Sagittarii, im. 10h. 59m. em. 11h. 54m.
29	3	28	☿ in the descending node
30			Clock after the ☉ 2m. 51s.
	—		☽ rises 11h. 33m. A.
	—		☽ passes mer. 3h. 15m. M.
	—		☽ sets 7h. 37m. M.
	—		Occul. *v* Capricornus, im. 13h. 14m. em. 14h. 30m.
	5		☽ in Apogee

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RECENT PATENTS.

To Evan Leigh, *of Ashton-under-Lyne, in the county of Lancaster, cotton-spinner, for certain improvements in steam-engines; and also improvements in communicating steam or other power for driving machinery.*—[Sealed 18th July, 1849.]

These improvements consist, firstly, in certain novel arrangements and constructions, forming various parts of a steam-engine; secondly, in the construction of that part of the apparatus used for generating the steam; and, thirdly, in a peculiar mode of transmitting motion from steam-engines or other motive power; and in the mode of connecting steam-engines to the paddle-wheels or other propellers of steam vessels.

In reference to the first head of the invention, the patentee has, for the sake of illustration, described his improvements as applied to an engine on the oscillating principle; there are several features thereof, however, which are equally applicable to engines of other ordinary constructions, all of which will be hereafter explained.

In Plate XIII., fig. 1, is an end elevation of an engine, provided with four oscillating cylinders; and fig. 2, is a side elevation of the same. Fig. 3, is a detached view, in section, of one of the cylinders, shewing the various steam passages and valves for opening and closing the same; fig. 4, is a detached sectional view of the air-pump; and figs. 5, and 6, are detached views of the apparatus for working an expansion valve, to regulate the flow of steam into the cylinder. The

framework of the engine is shewn at *a, a, a,* keyed by suitable means upon two foundation-chambers *b, b,* which constitute the condenser of the engine. The crank-shaft is shewn at *c, c, c,* and has two cranks *d, d,* formed thereon, actuated by piston-rods *e, e, e,* working in their respective cylinders *f, f, f.* To each crank are connected, by the ordinary means, two of the piston-rods *e, e, e,*—one of each pair passing through a fork formed in the other, as shewn in the drawing. The cranks *d, d,* are so arranged that they form an obtuse angle of 135°; so that, during the operation of the engine, the shaft *c, c, c,* will receive a fresh impulse at every quarter of its revolution. Instead of the cylinders being mounted upon hollow trunnions, which form steam passages, as in the ordinary mode of constructing oscillating engines, they are suspended upon centres *g, g,* affixed to bosses *h, h**, cast upon, or affixed to, the framework of the engine. The outward end of the boss *h**, of each cylinder is formed hollow, as shewn by dots at *i,* fig. 2, and communicates by means of a passage *k, k,* (also shewn by dots in the same figure), formed in the framework *a, a,* with the steam-pipe *l,* which leads from the boiler. The bosses *h**, are provided with ordinary stuffing-boxes, through which, at the centre of oscillation, a pipe *m, m,* is passed, communicating with the chamber *i,* and from thence to the steam-pipe *l.* The pipe *m,* is bent round, and its other extremity is attached to the steam-box *n*; steam, therefore, being admitted from the boiler to the pipe *l,* will flow through the passage *k*; from thence through the hollow formed in the boss *h**, and, by means of the pipe *m,* into the steam-box *n*; and, passing through passages formed in the cylinder, as shewn at *o, o,* will be admitted either above or below the piston, according to the position of the slide-valves *p, p.* The steam, having exerted its expansive power within the cylinder, is discharged through apertures *q, q,* into a chamber *r, r,* (formed by an outer casing or jacket surrounding the cylinder); and from thence it is conveyed, by a flexible pipe *s, s,* to the condenser or to the atmosphere, according to the description of engine to which it is applied. The pipe *s, s,* may be constructed of various materials, provided the means are obtained of allowing sufficient elasticity to provide for the oscillation of the cylinder; it is preferred, however, to construct it of vulcanized India-rubber and cloth, enclosing a wire-coil or rings. The attachment of the pipe *s, s,* to the cylinder, should be as near to the bottom thereof as possible, so as to draw off any water which may accumulate from the condensation of steam. In the case of large engines, instead of using the

flexible hose, the patentee attaches a metal pipe to the chamber *r, r,* and bends it round to the centre of oscillation in the boss *h,* in a similar manner to that described in reference to the induction-pipe *m,*—the boss *h,* in this case, being constructed hollow (so as to form an exhausting passage) and provided with a stuffing-box, as described in reference to the boss *h**.

The mode of constructing and applying the slide-valves of the engine is as follows:—Upon the face of the cylinder guides *t, t,* are screwed, which are accurately planed, and lap over bevilled edges formed on the sides of the valves, which are thereby kept in their places, and always exposed to view;—affording thus the opportunity of regularly applying oil, and of easily detecting any inaccuracies in their working. The valves are attached to cross-heads *u, u,* connected together by means of rods, as shewn in fig. 1, and have the requisite sliding motion given to them in any ordinary manner. On the top of the cylinder, immediately under the cap, is a chamber *v,* forming a receptacle for oil, and affording, at all times, a regular amount of lubrication to the piston of the engine. A similar chamber *w,* is also formed in the top of the gland, in order, in like manner, to supply oil to the piston-rod;—the oil is admitted to the chamber *v,* and gland *w,* through suitable pipes.

The patentee next proceeds to describe a method of working steam expansively. This object he effects by the use of an expansion-valve, worked by a distinct excentric to that by which the ordinary slide-valves are put in motion. By refering to figs. 5, and 6, it will be seen, that upon the crank-shaft an excentric *x,* is keyed, for the purpose of effecting the ordinary motion of the slide-valves; and to this excentric a ring *y, y,* having a spur-wheel, with internal teeth formed therein, is attached. Mounted loosely upon the boss of the excentric *x,* is another excentric *z,* from which a rod *z*,* passes, which is connected with the expansion-valve 1, fig. 3: this latter excentric is provided with a similar spur-wheel to that at *y, y,* as shewn at 2, 2. A worm-wheel 3, 3, is also mounted loosely upon the boss of the excentric *x,* and carries within it, by means of a short shaft turning freely therein, four small pinions 4, 4, 4; one pair of which pinions takes into the teeth of the toothed wheel upon the fast excentric *x,* and the other into the similar wheel attached to the loose excentric *z*; so that, as the fast excentric revolves with the crank-shaft, it will, by means of its toothed wheel and pinions, turn round the other pinions, which will communicate mo-

tion, through the spur-wheel, to the loose excentric *z*, and at an uniform speed, and in the same direction with that of the fast excentric *x*; providing that the worm-wheel 3, shall remain stationary. In this case the excentrics *x*, and *z*, will actuate the slide-valves and expansion-valve uniformly at every stroke of the engine; but if the said worm-wheel shall be caused partially to revolve, then, by means of the pinion 4, 4, the loose excentric will be caused to move around the crank-shaft, and its position, relatively with that of the fast excentric, will be altered. In order to effect this, the worm-wheel is connected with the governor of the engine, by means of a worm mounted on one end of a shaft, the other extremity of which is provided with a roller, running upon a friction disc, as shewn at fig. 1. By this method of working the steam expansively, the usual throttle-valve may be dispensed with, and the expansion-valve may be opened the full width of the thoroughfare at each stroke of the engine, however soon it may be cut off.

The construction of air-pump employed in connection with condensing engines is shewn at figs. 1, and 2, and also in the detached sectional view at fig. 4. 5, 5, is the cylinder of the pump, within which is placed a piston of any ordinary construction; the usual bucket-valves are however dispensed with. The passage leading to the condenser is shewn at 6, 6; which condenser consists, as before stated, of two chambers *b*, *b*, extending under the frame-work *a*, *a*, of the engine; the two chambers *b*, *b*, are connected by means of a cross channel 7, 7, and it is to this cross channel that the passage 6, 6, is opened. The passage from the air-pump is shewn at 8, 8, and may be taken off in any convenient manner. Upon the face of the air-pump a slide-valve 9, is mounted in a similar manner to that described in reference to the mode of fitting up the improved steam slide-valves; which valve 9, is connected, by means of a rod 10, to an excentric, mounted upon the crank-shaft of the engine. The piston is also worked by an excentric,—the cross head of the rod thereof moving in guides, as shewn in the drawing, or in any other convenient manner. In the position of the parts shewn at fig. 4, the piston, in its ascent, will force the air and water through the aperture 11, formed in the cylinder, and, from thence, through the cavity in the valve, into the discharge-pipe 8,—the space below the piston, in the mean time, being filled from the passage 6; the air and water ascending through the cavity 12, in the valve, and flowing into the cylinder through the opening 13, formed therein. The cylinder having descended, and

the valve shifted into the position shewn by the dotted lines, the air and water will be taken in on the upper side of the piston, and discharged at the bottom. To prevent the liability of the steam-valves drawing air, a channel is cut from the steam thoroughfare round the other thoroughfares on the face of the cylinder, which is covered by the valve; and if, from neglect, they get out of order, they will blow steam. A channel is also cut round the face of the air-pump valve, by which oil may be distributed over the face while working.

The improvements in communicating power from steam or other engines consist, firstly, in attaching to the crank of the engine a connecting-rod or rods, as shewn at 11, fig. 2; such rod or rods being similarly connected, by means of a crank or cranks, to the shaft to which it is desired to communicate motion. This mode of communicating power (the patentee remarks) will be found particularly available when used in conjunction with his plan of working steam expansively in four cylinders connected to one shaft; for, in such case, by the use of a short stroke, the speed necessary for driving the machinery may be got up at once, without the intervention of the gearing now commonly used.

The improvements in communicating steam power to paddle-wheels, or other propellers of vessels, consist in detaching the said propellers, and in connecting an engine or pair of engines to each, so that the propeller on one side of the vessel may be actuated independently of the other. For this purpose the worm-shaft 16, is carried in a vertical direction above deck; and, by turning this shaft, the quantity of steam given to one engine or a pair of engines is regulated. By these means the vessel is immediately steered in any required direction, without the aid of a rudder. The same object may be also effected by the employment of two throttle-valves, so connected together that, by turning the handle, one valve is opened wider and the other partially closed; or, in case of sudden emergency, one engine or a pair of engines may be reversed.

The improvements in apparatus used for generating steam are shewn at figs. 7, 8, 9, and 10. Fig. 7, is an end elevation of a pair of boilers on the improved plan,—one of such boilers being shewn in section; fig. 8, is a transverse section of one boiler, taken in the line *a*, *b*, of fig. 9, (which latter figure is a longitudinal section of the same); and fig. 10, is a partial horizontal view,—one of the boilers being shewn in section. The boiler is shewn at A, A, and, instead of being set in brickwork, according to the usual method, it is sup-

ported by chambers B, B, B, formed of thin plate metal. These chambers are filled with the water intended to be used in supplying the boiler; and, in order that steam may not be generated therein to an injurious amount, a communication is made in the upper part of the said chambers with the atmosphere. The hoppers for supplying fuel to the furnace are shewn at C, C, from whence it falls on to the dead-plates D, D. The doors and door-frames are shewn at E, E, and are affixed to a shaft F, which turns in a step G, attached to the boiler: this shaft has a slow vibrating motion communicated to it by any convenient connection with the engine. On the upper part of the door-frame E, E, are flanges H, H, which, when moved inwards, form the bottom of the hoppers C, C, as shewn best at fig. 10. By this arrangement, as the shaft F, F, is caused to vibrate to and fro, the flanges H, H, will be alternately removed from under the hoppers C, C, and thus allow the fuel to fall on to the dead-plate of the furnace; the motion in the opposite direction alternately closing the hopper, and, by bringing the fire-doors and frame in contact with the deposited fuel, thrusting it over the dead-plate on to the fire-bars. Fire-bars, of the ordinary construction, are shewn at I, I, I; in this instance, however, every alternate bar is omitted,—the spaces being filled by moveable or rocking-bars K, K, K. These bars are cast together upon a shaft L, which extends under the ordinary bars I, I, I, and is provided, at each end, with cranks M, M, (shewn by dots in fig. 9,); which cranks, at their upper ends, turn upon centres attached to the boiler. Projecting downwards from the shafts L, L, are other cranks N, N, connected by means of rods O, O, to levers P, P, attached to the vibrating-shaft F, F. By these means, as the said shaft moves to and fro, the bars K, K, will be caused to oscillate upon the centre pins of the cranks M, M, and thus prevent an accumulation of clinkers between them. It will be perceived, on inspecting the drawings, that the bars are divided into two sets,—those at the back being connected by means of a rod O*, so as to partake of the motion of the front ones. There are also two fire-places shewn to each boiler; and these fire-places are divided by a water-chamber, as shewn in the drawing, but connected by means of tubes Q, Q, in order to gain an increased heating surface. Behind the bridge of the furnace transverse and vertical tubes R, R, R, are also inserted, which communicate at each end with the boiler.

Under the first head of his invention, the patentee claims, Firstly,—the mode of mounting oscillating cylinders of steam-engines upon pointed or other centres, not being steam pas-

sages,—the steam being admitted by pipes, as before described, or by any other similar and suitable arrangement. Secondly,—the use of a flexible pipe, as before described, as applied to the exhausting or exit passage of oscillating steam-engine cylinders. Thirdly,—the use of a jacket surrounding the working cylinder, into which the exit steam is passed previously to its being discharged into the condenser or atmosphere. Fourthly,—the method described of mounting the slide-valves, whether as applied to oscillating engines, or to those with stationary cylinders,—such method consisting in exposing them to view instead of enclosing them, as ordinarily practised. Fifthly,—the method described of using steam expansively, whether such method be applied to oscillating or other engines; by which method the expansion-valve throws open the full width of the thoroughfare, however soon it may be cut off. Sixthly,—the use of the hollow cylinder, lids, and glands, as above described. Seventhly,—the use of four steam-cylinders operating upon one shaft, as before described, whether such cylinders are on the oscillating principle or otherwise, for the purpose of obviating the necessity of a fly-wheel. And, Eighthly,—the peculiar construction of air-pump described;—the essential feature of this part of the invention consisting in the adaptation of a slide-valve, for the purpose of opening the communication from the condenser to the hot well alternately on each side of the piston.

With reference to the second head of his invention, the patentee claims the use of water-chambers, from which the boiler is to be supplied, as forming the setting or support of such boilers, instead of the brickwork in ordinary use. Also the method shewn of supplying the fires with fuel by means of the moveable fire-doors and frames, in conjunction with the hoppers. And the particular arrangement of oscillating fire-bars, as above described.

Under the third head of the invention, he claims the method of communicating power by means of cranks and connecting-rods, as above described. And also the method described of acting at pleasure, by distinct engines, with variable power upon paddle-wheels or other propellers of steam vessels; such propellers being independent of each other.—[*Inrolled January,* 1850.]

To Edward Walmsley, *of Heaton Norris, in the county of Lancaster, cotton spinner, for his invention of certain improved apparatus for preventing the explosion of steam-boilers.*—[Sealed 27th April, 1848.]

This improved apparatus for preventing the explosion of steam-boilers consists, first,—in a certain novel arrangement of mechanism, designed for the purpose of opening the safety-valve in steam-boilers, whenever the steam in the same is raised beyond a certain density or pressure; and, secondly, in an arrangement of mechanism for admitting a draught of cold air above the furnace, or closing the damper in the flue leading to the chimney, whenever the pressure of the steam increases above a certain point or the water falls below a certain level.

In Plate XIV., fig. 1, is a sectional elevation of a low-pressure steam-boiler, with the improved apparatus shewn as attached thereto. *a, a,* is the boiler, supported in the brick-work *b, b,* in the usual manner; *c, c,* is the furnace or fire-place; *d, d,* are the flues; *e, e,* is the "man-way"; and *f, f,* is the safety-valve. It will be seen that the boiler *a, a,* is furnished with an upright pipe *g, g,* extending downwards through the top of the boiler, and opening near the bottom of the same, and likewise extending upwards several feet above the boiler, as shewn best at fig. 3, which is a complete elevation of the apparatus upon a reduced scale. The pipe *g,* is isolated from the currents of water in the boiler (that is, kept in still water), by being placed within another pipe *g*, g*,* of larger diameter. The height of the pipe *g, g,* above the level of the water, must be so regulated, that, when the steam in the boiler is of the required density, the pressure thereof shall cause a column of water to ascend the said pipe nearly to the level of the horizontal pipe *h, h,* which connects the pipe *g, g,* to the descending-pipe *i, i.* The safety-valve *f, f,* is connected by a link *k, k,* to the lever *l, l,* which has its fulcrum at *m,* and carries at one end a can or bucket *n,* furnished with a valve *o,* opening upwards. The other end of the lever *l,* is counter-balanced, and the valve weighted to the required pressure, by means of the weights *p, p.* The operation of this part of the apparatus is as follows :—Suppose the pressure of the steam required to be equal to about twelve pounds upon the square inch, then the end of the lever *l,* to which the valve is attached, must be weighted so that when the steam arrives at that density the lever *l,* will be balanced, or nearly so; and the height of the pipe *g, g,* above the water-line must be such that the pressure of the steam, at that density, will raise the column of water

nearly to the level of the horizontal pipe *h, h.* But as soon as the pressure of the steam increases, and raises the column of water above that level, it will flow along the horizontal pipe *h, h,* and descend the pipe *i, i,* (which is open to the atmosphere at the top) into the bucket *n,* and, by its weight, destroy the equilibrium of the lever *l,* and cause the other end thereof to rise and open the safety-valve. The bottom of the bucket is pierced with a small hole, so that if only a small quantity of water descends the pipe *i, i,* it will all run out into the cistern *g, g,* below, before the bucket has descended far, and thus allow it almost immediately to resume its original position; but if a larger quantity of water falls into the bucket *n,* than can run out through the small hole, the bucket still keeps descending until the tail of the valve *o,* comes into contact with the bottom of the cistern *g, g,* when the valve will open and let out the water,—thereby allowing the bucket *n,* to rise and the safety-valve to close.

The arrangement of mechanism for admitting cold air above the furnace, in the event of the steam being raised to too high a pressure, or the water falling below its proper level, is as follows:—*r, r,* is a cold air flue, opening above the dead-plate of the furnace, and capable of being closed at the top by a cover *s.* This cover *s,* is connected by a rod *t,* to one end of the lever *u,* the other end of which is attached to a float *v,* in the boiler by the rod *w.* The lever *u,* is also connected by the pin *x,* to the lever *l.* It will be evident, therefore, that whenever the water falls below its proper level, the action of the float *v,* will cause the lever *u,* to raise the cover *s,* and admit cold air above the furnace; and that the motion of the lever *l,* occasioned by the descending of the bucket *n,* will have the same effect. The patentee remarks that, if preferred, the motion of the lever *l,* may be made to open or close the damper *y,* in the flue leading to the chimney. Fig. 2, shews a modification of the invention, which may be applied to high-pressure steam-boilers. It will be seen that in this arrangement it is not necessary to carry the pipe *g,* to any great height. At the upper end of the pipe is a valve-box *z,* having a valve inside, and weighted by a lever 1, 1, similar to an ordinary safety-valve or otherwise; so that, when the pressure of the steam increases, the column of water will raise the valve, and, flowing down the pipe *i, i,* will open the safety-valve by means of the lever *l,* as in the other arrangements.

The patentee claims, First,—the method of opening the safety-valve of steam-boilers, when the steam is raised beyond a certain density or pressure, by means of a column of water

in the ordinary feed or other pipe, acted upon by the steam itself; and also the method of closing the safety-valve, when the steam is reduced to its ordinary working pressure, by stopping the flow of water from the boiler, and by releasing the water from the bucket,—thus making the apparatus in effect self-acting. Secondly,—the self-acting method, as above shewn and described, of admitting a current of cold air above the furnace, whenever the water in the boiler falls below its ordinary level, or the steam is raised beyond the density or pressure desired.—[*Inrolled October*, 1848.]

To John Longworth, *of Newton Heath, in the county of Lancaster, skinner and tanner, for his invention of certain improvements in pickers for power looms.*—[Sealed 10th April, 1848.]

The patentee remarks, that pickers are ordinarily made of buffalo hide, and, from their form, are subject to hard wear, which quickly destroys them, and renders it necessary that they should be continually renewed.

The present invention refers to a novel and particular form or configuration of "pickers;" whereby such continual wear and tear is materially decreased, and a consequent economy in power-loom weaving is effected. The improved pickers are to be made of buffalo hide, or other strong substitute therefor, such as India-rubber or gutta-percha. The invention consists, first, in the peculiarity of the form of the picker; secondly, in folding or wrapping buffalo hide, or other like substance, in such a manner as to form a solid picker, with two good fronts or striking parts (whereby they are rendered capable of being used upon either side of the loom, or of being alternately reversed when worn by their action upon the shuttle); thirdly, in constructing the picker in such a manner that the shuttle is prevented from being struck or coming in contact with the edges of the buffalo hide, or other substance from which the picker is made; and, fourthly, in constructing pickers in such a manner, and of such a shape, as will enable them to be used with or without the "spindles" upon which they commonly slide or work, and also to prevent them from being broken up before they are entirely worn out by the action of the points of the shuttle.

In Plate XIV., fig. 1, shews, in side view, and fig. 2, in top view, the first description of improved picker. It will be seen that this picker is solid, and is formed by folding or

wrapping the buffalo hide, as shewn clearly at fig. 2. It is made by taking one or more pieces or strips of hide, and folding it on a mandril,—thereby forming the outer part or casing *a, a,* of the picker; and thus forming the two fronts or striking parts, or those opposed to the points of the shuttle. Into this outer casing, an inner strip or closely-folded piece of hide *b, b,* is placed, the lower or projecting end of which runs in the guides or groove in the slay or lathe. The parts are then pressed or squeezed together and fastened by rivets, screws, or staples *c, c.* *d,* is a staple-wire, placed on one side, for attaching the picker to the picking-band. An aperture is formed at *e,* for the purpose of lessening the surface exposed to friction whilst the picker is running on the spindle, which passes through the opening or hole *f,* in the upper part of the picker.

Another and lighter description of picker is shewn at figs. 3, and 4, which is made much in the same manner as the former, but having the sides depressed for the sake of lightness, and still preserving a solid picker, with two fronts or striking surfaces;—the picking-band may either be attached by a staple, or placed through the hole in the upper part of the picker.

Another slight modification of picker is represented at figs. 5, and 6. The picker in this instance is made in a similar manner to that shewn at fig. 1, with the exception of the inside piece or folds of the hide: in this picker the inside folds are larger, and extend through the outer casing, both above and below, and thus form a guide-piece or "leg" at both ends of the picker, which will enable pickers to be worked without the friction caused by their sliding upon the spindles, as usual;—as the picker may thus be guided in its direct course by means of the projections or ends running in grooves suitably formed in the lathe or slay.—[*Inrolled October,* 1848.]

To Edmund Hartley, *of Oldham, in the county of Lancaster, mechanic, for his invention of certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton and other fibrous substances.*—[Sealed 11th December, 1848.]

This invention of improvements in machinery or apparatus to be employed in the preparation and spinning of cotton and other fibrous substances, applies, firstly, to those machines used in the preparation of cotton known as "roving and slub-

bing-frames," and has for its object the decrease of the vibration or oscillation, and also of the wear and tear of the spindles; at the same time, allowing of their running at an increased velocity. The second part of the invention relates to those machines used for spinning cotton and other fibrous substances now generally called "self-acting mules," and more especially to that class known as Roberts's self-actors, which machines are well known to practical cotton spinners, and require no further explanation. This part of the invention consists in a novel method of working the "backing-off" motion, whereby certain parts of the machinery hitherto employed are dispensed with.

The practical application of the improvements will be readily understood by the following explanation; reference being had to the figures in Plate XIV., wherein fig. 1, is a front elevation of a roving-spindle and flyer, shewing the application thereto of the improvements in machinery for preparing cotton, forming the first head of the invention; and fig. 2, is a side or edge view of the same. *a, a,* is the spindle; and *b, b,* is the flyer. The first improvement under this head of the invention consists in retaining the diameter of the upper part of the socket of the flyer *d,* as usual, and reducing the diameter of the lower portion *c,* of the socket of the flyer to that of the spindle *a,*—the upper part of the spindle *a,* being also reduced, in order to fit into it. The object of thus reducing the exterior of the lower portion of the socket to the diameter of the spindle is, in order to allow of the bobbin working up as far as the shoulder *d,* of the socket; in consequence of which, the spindle *a,* and the arms *b, b,* of the flyer, do not require to be so long;—by which means, the weight of the spindle and flyer is reduced, and the spindle may be run at an increased velocity.

The second improvement under this head consists in placing the bevil-pinion *e,* (which drives the bobbin) upon a bush or tube *f,* instead of placing it upon the bare spindle, as heretofore. This bush or tube *f,* is of one and the same piece with the common bolster or bearing *g,* (see fig. 2, in which the bevil-pinion *e,* and its boss are represented in section). By the application of this part of the invention, the vibration or oscillation of the spindle is considerably diminished, an increased speed is also attainable, and the wear and tear of the spindle itself is, at the same time, greatly decreased.

The second head of the invention, which applies to machinery or apparatus to be employed in spinning cotton, &c., is distinctly illustrated by figs. 3, and 4. Fig. 3, shews a

plan or horizontal view of that part of the headstock of an ordinary "self-actor" which governs or regulates the backing-off motion. *a, a,* is the main-shaft, or, as it is technically termed, "rim-shaft;" *b,* is the backing-off pulley; *c,* is the "horse-shoe spring;" *d,* is a lever, to the end of which the bowl *e,* is attached; *f,* is the cam; and *g,* is the cam-shaft. In the improved arrangement (a plan view of which is shewn at fig. 4,) the horse-shoe spring *c,* and lever *d,* are dispensed with. Upon the cam-shaft *g,* is a moveable cam *h,* constructed as represented in the drawing, and so adjustable on the shaft *g,* as to admit of its being fixed or regulated to its proper position by means of the two nuts *i,* and *k,* one on each side of the cam. The principal object of this invention is to allow the backing-off motion to be regulated from the cam-shaft, and prevent the sudden check which is caused by the plan hitherto in use; as the motion, in this case, can be regulated with the greatest nicety by means of the two nuts *i,* and *k,* as above described.

The patentee claims, First, with regard to the machinery or apparatus to be employed in the preparation of cotton for spinning, retaining the diameter of the upper part of the socket of the flyer *d,* as usual, and reducing the diameter of the lower part of the socket *c,* of the flyer to that of the spindle, together with shortening the arms of the flyer, for the purpose above mentioned. Secondly,—the application of the bevil-pinion *e,* which drives the bobbin, to a tube or bush, as at *f,* instead of its being placed upon the bare spindle, as heretofore, in slubbing and roving-frames. And, Thirdly, with regard to the machinery or apparatus for spinning cotton and other fibrous substances, he claims the method of working the backing-off motion (in self-acting mules) as above described and shewn in the drawing.—[*Inrolled June,* 1849.]

To John Shaw, *of Glossop, in the county of Derby, musical instrument maker, for certain improvements in air-guns.*—[Sealed 1st August, 1849.]

This invention of improvements in air-guns consists in the novel combination and arrangement of a condensing-syringe or pump and a spring, attached to, and forming part of, the gun,—whereby a sufficient pressure of air for one discharge may be instantly procured at the pull of the trigger, without any previous pumping or condensation of air, as hitherto required in ordinary air-guns.

In Plate XIV., fig. 1, represents a longitudinal section of an air-gun,—the parts being in the position they would assume when the gun was loaded and ready for a discharge. *a, a,* is the barrel of a condensing-syringe or air-pump, to which, at the end next to the trigger, the air has free access through suitable openings; and to the other end of which the block *b,* is closely fitted, as hereafter described. This block is pierced with two holes, one in the middle, which is provided with a steel bush, fitted to receive the steel piston-rod *c,* and the other hole near the top of the block, into which the end of the shot-barrel *d,* is screwed. *e,* is the piston, tightly screwed on to the end of the piston-rod *c.* That part of the piston which is next the trigger is of brass, with a steel bush in the middle, for the trigger to catch in; the opposite side of the piston is of leather, and is kept from slipping up the piston-rod by the small metallic nut *f.* *g,* is an endless vulcanized India-rubber band, extended to about six and a half times its original length, so as to become or act as a spring of considerable power; one part of which is attached, by a linen-thread loop, to the hooked end of the piston-rod; and the opposite portion, in like manner, to the steel hook *h,* which is soldered to the inside of the muzzle end of the barrel-casing *l.* In this figure only one endless India-rubber band is shewn; but any number of them, sufficient to form a spring of the requisite strength, may be used. *i,* is the bullet, which, until the moment of discharge, is detained in the situation shewn by a slight contraction of that end of the shot-barrel; by which contraction the bullet is also prevented from being rammed down into the syringe or pump *a.* *j,* is the trigger, on pulling which the piston is disengaged, and, by the reactive force of the India-rubber spring *g,* it rushes to the opposite end of the pump or syringe-barrel; thereby condensing the air in the barrel, by which the bullet is forcibly ejected. *k, k,* is a hardened steel bush, screwed into a recess in the rear of the piston; the hole in the middle of the bush is widest on that side next to the trigger; and the recess in the piston is wider than the hole in the bush; so that, in "cocking" the gun, as hereinafter described, the catch of the trigger is depressed until the inner edge of the bush has passed over the catch of the trigger; the trigger is then raised by the spring *q,* at its back,—the piston being then secure until the trigger is pulled. *l, l, l,* is a casing, which, with the exception of a narrow slot *m, m,* encloses the shot-barrel *d,* and India-rubber spring *g.* *m, m,* is a slot in the case, into which an instrument is to be introduced, for

the purpose of cocking the gun, as hereafter described. *n*, is a moveable cap, which closes the end of the case, and supports the muzzle end of the shot-barrel; for which purpose the cap is perforated near its upper edge. *o*, is a metallic loop, projecting from the casing, for the reception of the bolt that holds the gun in the stock *u, u*; and also holds the casing *l, l, l*, in its place. When the gun is taken from the stock, the casing, as far as *p, p*, can be slidden off the syringe or pump-barrel, taking along with it the block *b*, the piston-rod *c*, and the piston *e*. *r*, is the breech, to which the rear of the pump-case or syringe-case is soldered, and in a slot of which the trigger *j*, oscillates on the steel pin *s*. *t*, is a knob or bead of brass, soldered on to the piston-rod *c*; on to which bead the cocker is hooked when cocking the gun. *w*, is a slot in the case, through which the trigger is introduced after the gun is put in the stock. Fig. 2, represents an underneath view of the exterior appearance of the gun, taken from the stock, shewing the slot *m, m*; through which are visible the piston-rod *c*, the bead *t*, and a small portion of the India-rubber spring *g*, as they appear after the gun is discharged, and prior to their preparation for another discharge. Fig. 3, represents, in perspective view, an instrument for cocking the gun: it is made of steel, and hooked on to a portion of the piston-rod *c*, and the bead *t*. In order to cock the gun, the "cocker," here represented, must be introduced into the slot *m, m*, and fitted on to the piston-rod between the hook and the bead, in the manner indicated by fig. 3: when the cocker is thus fitted, the butt end of the gun must be supported on the top part of the thigh or other suitable part of the person; and the cocker must then be pulled by the hooks *v, v*, in the direction of the breech, till the trigger catches and holds the piston in the position represented at fig. 1. A hole in the case, through which the trigger-pin is introduced, serves, together with the slot *w*, to admit air to the back of the piston when the gun is being discharged. Should the bullet be rammed down before the gun is cocked, air is admitted into the syringe or pump-barrel through a small hole at *y*. Fig. 4, is an enlarged sectional view of such parts of fig. 1, as are indicated by corresponding letters of reference: the piston in this figure is shewn as just released from the trigger. Fig. 5, represents, in section, the breech *r*, detached and turned round, so as to shew the trigger-slot. Fig. 6, shews, in sectional view, the block *b*, with its steel bush, for the piston-rod to work through. Fig. 7, is a perspective view of the muzzle cap *n*, detached.

The patentee claims the condensing of the air in air-guns, at the instant of discharge, by one stroke of an air-pump or syringe, actuated by a previously extended or compressed spring, or other suitable elastic means.—[*Inrolled February,* 1850.]

To William Browne, *of St. Austell, in the county of Cornwall, mine agent, and* Richard Rowe Veale, *of St. Columb Major, in the said county, Gent., for improvements in preparing, for pulverization, flint-stone, china-stone, ores, minerals, spas, sands, earths, and other substances.*—[Sealed 27th September, 1849.]

The patentees commence their specification by stating, that the breaking down of flint-stone, china-stone, ores, minerals, spas, sands, earths, and other natural substances, and also artificial substances, such as glass, vitreous matters, and slags, requiring to be reduced to a pulverized state, is a tedious and costly process; and although the cost of such process, with some natural matters, is considerably reduced by subjecting them to a preparatory calcination, still the breaking down of the calcined matters is expensive. Now, this invention consists in preparing the above-mentioned substances for pulverization, by exposing them to a high degree of heat, but not so as to fuse the same, and then subjecting them to the action of water.

In carrying out the invention, the patentees prefer to bring the substances to a bright red heat, and while in that state to suddenly immerse them in water; but, instead of immersing the hot substances in water, the hot water may be thrown on to them, or steam may be admitted amongst them. By thus treating the above-named substances, the process of pulverization may be much more easily carried on. It is stated, that this invention will be found particularly advantageous for preparing materials to be used in the manufacture of china, glass, earthenware, and porcelain; for facilitating the extraction of metals from ores; and for preparing materials for making paints, manure, and cements.

The patentees claim the preparing flint-stone, china-stone, ores, minerals, spas, sands, earths, and other substances, by heating the same to a high degree of heat, but not so as to fuse the same, and then subjecting them to the action of water.—[*Inrolled March,* 1850.]

To WILLIAM PEACE, *of Haigh, near Wigan, in the county of Lancaster, and* EDWARD EVANS, *of Wigan, aforesaid, engineers, for improvements in steam-engines and in pumps.*—[Sealed 20th September, 1849.]

THE object of the first part of this invention, which relates to the pistons of steam-engines, is to dispense with the employment of bolts and nuts in the construction of the pistons; and this is proposed to be effected by making the upper and lower parts of the same of one solid piece of metal, with a recess or recesses therein for the reception of the packing by which the piston is caused to work steam-tight within the cylinder.

In Plate XV., fig. 1, is a vertical section of a piston, constructed according to this invention; and fig. 2, is a horizontal section of the same. *a*, is the body of the piston; *b*, *b*, are cells or hollows made therein, for the purpose of diminishing the weight; and *c*, *c*, are metal packing rings, which are kept close to the side of the cylinder, and close to the upper and lower parts of the recesses containing them, by the springs *d*, *d*, or springs of any other suitable form, acting on the backs thereof. The rings *c*, are bevilled on the surfaces which work in contact with each other; and that ring which presents the largest base inwards, and against which the springs *d*, act, must be made rather thinner (as shewn at c^1,), so as not to touch the side of the cylinder, or it must be made of softer material than the other ring, so as to wear away faster;—the object being that the narrower or softer ring may be always pressing, by means of its bevilled surface, both upwards and downwards, as well as horizontally, and thus keep the upper and lower parts of the recess in the piston steam-tight, at the same time that the packing is caused to work steam-tight against the side of the cylinder.

A ring of vulcanized India-rubber or other elastic material may be substituted for the rings *c*, and springs *d*, above mentioned, as shewn at figs. 3, and 4;—fig. 3, being a vertical section and fig. 4, a horizontal section of a piston. *e*, is the ring of India-rubber, which, by its elasticity, will fit steam-tight to the upper and lower surfaces of the recess, and at the same time will keep the packing rings *f*, *f*, in close contact with the sides of the cylinder. *g*, is a metal ring, which is employed to prevent the elastic ring from getting into the cells *b*, of the piston, and to serve as an abutment against which the elastic packing may act.

The second part of this invention consists of an elastic or

expansion joint for the pipes of steam-engines and boilers, pumps, and air-vessels,—which joint is so constructed as to admit of the expansion and contraction consequent on variations of temperature, as also to relieve the extreme pressure and sudden shocks resulting from the alternating action of pumps, and thus prevent the fracture of the pipes or joints.

Fig. 5, is a vertical section of a joint constructed according to this part of the invention. *h, h,* are two wrought-iron annular plates, rivetted or otherwise attached to the cast-iron flanges of the steam, air, or water-pipes *i, i,* and thus forming wrought-iron extensions of the cast-iron flanges. The plates *h, h,* are secured together perfectly tight at their outer edge, by inserting between them a metal ring *j,* with a vulcanized India-rubber washer on each side of it, and then securing the whole together by the bolts and nuts *k.* Or the plates may be secured perfectly tight at the outer edge by simply placing a perforated metal ring between them, and rivetting the whole together, as shewn in the sectional view fig. 6. In both modes of fastening, the outer ring keeps the flanges of the pipes, and the rivets therein, far enough apart to admit of the elongation or contraction of the pipes without bringing the ends of the cast-iron pipes in contact;—the elasticity of the wrought-iron plates admitting of such variation in the length without fracturing the pipes or breaking the joints.

The patentees claim, Firstly,—making the pistons of steam-engines, both top and bottom, in one solid piece, having a recess for the packing; and the adaptation thereto of packing-rings, of the peculiar form and construction above described. Secondly,—the elastic or expansion-joint, for steam-engine, boiler, and other pipes, formed of wrought-iron plates, attached to the flanges of the pipes, as above described.—[*Inrolled March,* 1850.]

To William Stedman Gillett, *of Wilton-street, Grosvenor-place, Esq., for improvements in packing pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings, and in making cylinders and other forms of metal.*—[Sealed 12th October, 1849.]

This invention consists in the employment of a series of dished discs or annular plates of metal, pressed together, as packing for pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings, and making cylinders and other forms of metal.

In Plate XV., fig. 1, is a vertical section of a piston furnished with the improved packing; and figs. 2, exhibit a plan view and section of one of the dished annular plates detached. *a, a,* are the discs or plates, which are made of soft or anti-friction metal, except the uppermost and lowermost ones; and these are made of brass or other hard metal; but, if preferred, all the plates may be made of the same metal. The outer edges of the discs are pressed into close contact with the internal surface of the cylinder, in which the piston works, by screwing down the screw-bolts *b,* and thus depressing the top plate *c,* of the piston, which bears upon the upper and outer edge of the top disc; and the pressure so exerted upon the discs will tend to force them from a dished into a flat form, and thus to expand or enlarge the diameter of the packing. The packing may be adjusted from time to time by screwing down the bolts *b,* until the discs are brought into a perfectly flat state; and then they are to be removed, and a new set of suitably dished discs substituted for them.

Fig. 3, is a vertical section of a stuffing-box, provided with the improved packing; and figs. 4, exhibit a plan view and section of one of the dished discs detached. In this case, as the packing is required to be in close contact with the periphery of a cylindrical rod, in place of the internal surface of a cylinder, the position of the dished discs is reversed; therefore, as the plate *c,* is depressed, by means of the screw-bolts and nuts *b,* it will bear upon the upper and inner edge of the top disc or annular plate, and thus press the inner edges of the discs downwards; and as the discs are confined by the cylindrical part *d,* of the stuffing-box, they cannot expand outwards, but their inner edges will be forced downwards and inwards, so as to come into close contact with the periphery of the rod *e.*

A series of dished plates of any suitable form, firmly pressed together, may also be used as packing for slides, bearings, and other parts of machinery. The patentee likewise proposes to make cylinders and other forms of metal, which are required to be of great strength, but are not subject to wear (such as hydrostatic cylinders), by placing a series of dished discs or plates of metal around an internal cylinder (although such internal cylinder is not absolutely necessary) between suitable top and bottom plates, and then combining and pressing them firmly together by means of screw-bolts and nuts.

The patentee claims, as his invention, the employing a series of dished discs or plates of metal, pressed together, as packing

for pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings, and in making cylinders and other forms of metal.—[*Inrolled April,* 1850.]

To ENOCH CHAMBERS, *of Birmingham, smith, for improvements in the manufacture of wheels.*—[Sealed 10th November, 1849.]

THIS invention consists in improvements in manufacturing wrought-iron wheels.

In Plate XV., fig. 1, exhibits a wheel, made according to this invention; fig. 2, is a transverse section thereof; fig. 3, is a side view of one-half of the wheel; fig. 4, is a transverse section of the same; and fig. 5, is a transverse section of a railway-tyre of the ordinary construction, to be applied to this wheel. The wheel is made in two halves;—each consisting of one-half of the nave, one-half of the spokes, and one-half of the felloe or inner rim; and being formed wholly of wrought-iron. For each half of the nave, a block of iron is forged into a short cylindrical piece, with a flange or projection all round it; and this flange is drawn out by forging, so as to form projecting pieces at those parts where the spokes are to be welded on. It is requisite that the wheel should have an even number of spokes,—half affixed to one-half of the nave, and the remainder to the other half of the nave; which spokes are to be placed in such relative positions that those of the one half shall be situated between, or alternate with, those of the other half of the nave; and as each spoke has a portion of the felloe forged thereon (as clearly shewn at figs. 3, and 4,), the felloe will be complete when the two halves of the wheel are brought together. After the spokes have been welded on to the half naves, the two half naves are brought to a welding heat and welded together by a hammer or press (a steam-hammer being preferred); the different parts of the felloe are welded together; the tyre is shrunk on; and then the centre of the nave is cut or turned out suitable to receive the axle.

Instead of the spokes being welded to the half naves before the latter are welded together, the spokes may be welded on afterwards. In the above description only railway-wheels are referred to; but the invention is equally applicable to wheels for common road carriages and waggons.

The patentee claims, as his invention, Firstly,—manufacturing wheels by first making the nave in two parts (divided

vertically), each having half the entire number of spokes, with a portion of the felloe attached to each spoke; and then welding together the two half naves; after which the tyre is shrunk on as usual. Secondly,—making wrought-iron naves with two flanges, each to receive and have welded thereto one half of the spokes of which a wheel is to be composed.—[*Inrolled May,* 1850.]

To HENRY LAMPLOUGH, *of Snow hill, consulting chemist, for a new mode of supplying pure water to cities and towns.*—[Sealed 24th November, 1849.]

THE mode of supplying pure water to cities and towns, which constitutes this invention, consists in causing it to pass through a system of pipes and syphons, so arranged and combined, in connection with the source of supply and suitable intermediate reservoirs, that the water may be supplied as required, without being contaminated or polluted with extraneous matters.

The arrangements for this purpose are shewn in Plate XV., in which fig. 1, is a longitudinal section of the line of pipes employed; and figs. 2, 3, and 4, are transverse sections, on a larger scale than fig. 1, shewing the manner in which the pipes are conducted along a railway excavation, over a railway bridge, and along a railway embankment. *a, a,* are the pipes for conveying the water; 1, 2, 3, are syphon-pipes; *b,* is the source of supply; c^1, c^2, c^3, are intermediate reservoirs; and *d,* is the depôt from which the water is distributed to the desired parts of the town. The pipes, which may be of iron, glass, or other suitable material, are to be laid upon or by the side of a railway, canal, road, or any other convenient situation; and they are to be joined together by any of the ordinary methods. The filling and working of syphon-pipes is well understood; and in the event of it being necessary to pass the water over any elevation exceeding thirty feet, propulsion, by artificial means, may be resorted to; but the patentee does not make any claim to the use of such artificial means, except in connection with a system of syphon-pipes, combined and arranged, as above described, for the purpose of supplying water to towns. In conclusion, the patentee states that his invention consists in combining and arranging a series of pipes, reservoirs, and syphons, in the manner above described and represented, for the purpose of conducting water to towns.—[*Inrolled May,* 1850.]

To Alfred Vincent Newton, *of the Office for Patents*, 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in manufacturing leather, —being a communication.*—[Sealed 17th November, 1849.]

The objects designed to be obtained by the present improvements in manufacturing leather are, the expediting of the operation, lessening the cost of manufacture, and at the same time producing leather of superior quality. These three objects, it is stated, have not hitherto been attained simultaneously; for when it has been attempted to diminish either the duration or expense of the operation, the leather has proved to be of inferior quality.

The inventor first describes the operation of his improvements, which are applicable to the manufacture of every kind of leather, as applied to leather intended for currying; supposing 100 calf-skins are to be operated upon, each weighing (when in a fresh state and with the hair on) about 8 lbs. These skins, having been deprived of the hair, and perfectly freed from lime (assuming that substance to have been employed for the removal of the hair), and having been properly dressed, are submitted to the tanning operation. For this purpose, the following ingredients are to be mixed with a quantity of water, sufficient for their complete solution, viz., 20 lbs. of the sulphate of alumina and potash (alum) and 10 lbs. of chloride of sodium: this solution is to be poured into a vat, which is designated No. 1. Into a second vat, called No. 2, a solution formed of 100 lbs. of mimosa catechu, rich in tannin and coloring matter (supposing this to be the substance employed in tanning), is poured. Into a third vat, called No. 3, a solution of 4 lbs. of sulphate of alumina is poured, either alone or in combination with 2 lbs. of chloride of sodium.

To prepare a mixture for soaking the skins, the inventor takes one-fifth part of the contents of the vessel No. 1,—that is to say, a quantity of fluid equal to 4 lbs. of the sulphate of alumina and potash (alum) and 2 lbs. of chloride of sodium,—one-tenth part of the contents of the vessel No. 2, which would contain 10 lbs. of mimosa catechu,—one-fourth of the contents of the vessel No. 3, equivalent to a pound of sulphate of alumina and half a pound of chloride of sodium,—and pours the whole into a vessel of suitable capacity for soaking the skins (designated as the vat A); and to the mixture he adds a quantity of water, sufficient to cover the hundred skins above mentioned. The liquid in the vat A, is then heated to

about 25° Beaumé, and the skins which are ready for tanning are dipped, one by one, in the vat A, and left therein. Three or four men, placed round the vat, each armed with a stick rounded at the end, must then move the skins round, as near as possible to the edge of the vat, and continue this rotary movement for about an hour; or, instead thereof, any suitable mechanical arrangement may be employed, if thought desirable: at the expiration of the hour the skins are removed from the vat.

The next operation is to prepare a mixture of one-fifth part of the contents of the vat No. 1, equal to 4 lbs. of the sulphate of alumina and potash (alum) and 2 lbs. of chloride of sodium,—one-tenth part of the contents of the vat No. 2, viz., 10 lbs. of mimosa catechu,—one-fourth part of the vat No. 3, equal to 1 lb. of sulphate of alumina and half a pound of chloride of sodium,—and to pour the whole into the vat A. In this vat the skins are again placed, the temperature of the liquor is kept up to about 25° Beaumé, and the stirring is recommenced and continued for several hours. The skins are then again taken out and afterwards re-immersed in the vat A, where they are allowed to remain until the next morning. The next day the skins are removed, the liquor in the vat A, is brought to a lukewarm temperature, and to it is added one-fifth of the contents of the vat No. 1,—that is to say, a quantity of its contents equal to 4 lbs. of the sulphate of alumina and potash (alum) and 2 lbs. of chloride of sodium, —and one-fifth of the contents of the vat No. 2, equivalent to 20 lbs. of mimosa catechu. The soaking operation is then continued for some hours; after which the skins are taken out, and again returned to the vat A, where they must remain until the next day. If the tanning operation is to be continued in the vat A, the skins must be removed at least once a day, and before re-immersing them the liquor should be briskly stirred: each time the skins are immersed they should be laid in the vessel as flat and evenly as possible. At the sixth or seventh day from the commencement of the operation, the skins are taken out, and into the vat A, is poured the remainder of the contents of the vat No. 1, equivalent to 8 lbs. of the sulphate of alumina and potash (alum) and 4 lbs. of chloride of sodium,—the remainder of the contents of the vat No. 3, equal to 2 lbs. of sulphate of alumina and 1 lb. of chloride of sodium,—and also one-fifth of the contents of the vat No. 2, equal to 20 lbs. of mimosa catechu. When stirred together, the skins are soaked therein for some hours; and the operation of removing the skins for a few moments every day is

continued. On the fourteenth or fifteenth day there is added to the contents of the vat A, about two-fifths of the contents of the vat No. 2, equal to 20 lbs. of mimosa catechu; and six or seven days afterwards the remaining two-fifths, viz. 20 lbs. of mimosa catechu is added. At the expiration of five or six days from the commencement of the treatment, the skins must be carefully examined, by cutting slits in their thickest parts, in order to observe the progress of the operation; the strength of the tanning-liquor must be kept up, in order that the leather may not lose its swelling or thickening, so that it would sink; for this purpose a fresh dose of mimosa catechu may be added if requisite. At the expiration of about four or five weeks from the commencement of the operation, the conversion of the skins into leather will be completed: this may be ascertained by making incisions in the thickest parts of the skins, which ought to be impregnated uniformly in every part.

The hides thus prepared will, it is stated, prove of fine color and quality. When the operation is completed, and the skins are required to be curried, they should be hung up for about twenty-four hours on the frame, and they will then be ready for currying.

The inventor next describes a method of converting hides or skins into leather, by which the mode ordinarily employed is not very materially departed from.

When about the tenth day of the operation has arrived, and the skins have been subjected to the various successive immersions in the fluids prepared according to the directions already given, and with the precautions and peculiar manipulation above described, they are taken from the vat A, and laid in powdered bark, in the proportion of two or three pounds to each skin;—the powder is to be damped with a portion of the liquor from the vat A, or with bark liquor sharpened a little. The tan-pit is to be provided with a wooden hand pump, of the kind usually employed by tanners, and every two or three days the liquor should be pumped from the bottom of the pit, and allowed to fall into it again, in order to maintain a perfect mixture of the liquor, and render it throughout as homogeneous as possible.

The above-described operation will be the same for all soft leather, no matter whether the skins operated upon be calf-skins, goat-skins, sheep-skins, cow-hides, heifer-skins, or seal-skins, &c. The proportions of the substances will, however, vary for different kinds of skins: thus, for one hundred goat-skins, sheep-skins, or seal-skins, dissolve in a sufficient

quantity of water from 8 to 10 lbs. of the sulphate of alumina and potash (alum), 6 lbs. of chloride of sodium, and from 50 to 60 lbs. of mimosa catechu. For one hundred calf-skins, each weighing (in the fresh state and with the hair on) about 8 lbs., the proportions have been already given. For one hundred cow-hides, each weighing (in the fresh state and with the hair on) about 48 lbs., and intended for the upper leathers of shoes and boots, the proportions will be—sulphate of alumina and potash (alum) 100 lbs., chloride of sodium 50 lbs., and mimosa about 500 lbs.

If it be desired to tan by laying the skins in the tan-pit, the operation must be proceeded with as described above when speaking of that process: the proportion of bark employed should be about 3 lbs. for every 8 lbs. of skins (fresh, and with the hair on).

When it is desired to tan strong leather, to be curried for harness or trunk-making, there will be required, for every hundred skins, from 200 to 300 lbs. of the sulphate of alumina and potash (alum), and about 100 lbs. of chloride of sodium. One-half the quantity of chloride of sodium may be employed, substituting therefor an equal quantity of sulphate of soda or magnesia, if a brighter color and a firmer or harder quality of leather be required. Sulphate of alumina may, however, always be employed for calf-skins.

To tan skins for the manufacture of soft leather, such as calf or goat-skins, for boots and shoes, the preparation used, for every hundred skins, is from 2 to 3 lbs. of the sulphate of alumina and potash (alum), and an equal quantity of chloride of sodium;—for every hundred cowhides, from 40 to 50 lbs. of sulphate of alumina and potash (alum), and one-half the quantity of chloride of sodium.

The tannin and coloring matter may be applied in the form of liquid extract of bark, if found more convenient for the coloring of the products. It may be here remarked, that, after the completion of the tanning operation, the liquors employed still retain a fifth or sixth part of their strength; and that advantage must be taken of this, by diminishing the quantity of the different ingredients in proportion, and thus utilitizing the liquor which had been before employed.

The operation above described may be divided into two distinct operations, as follows:—

1*st. Operation.*—*White tanning or dressing.*—In this case, the sulphate of alumina and potash (alum) and the chloride of sodium are dissolved; and, if they are employed in the

proportions indicated, the skins must be treated in the manner required for dressing.

2nd. *Operation.—Coloring tanning.*—The skins are, in this case, kept immersed in mimosa catechu (which must be employed in the manner and proportions above mentioned) until they are completely saturated.

For the manufacture of hard leather, it is desirable to employ, as far as possible, skins unhaired when dry, as they must not be abated.

For ox-hides weighing 200lbs., from 14 to 16lbs. of sulphate of alumina and potash (alum) must be employed, and 5 per cent. of chloride of sodium: that is to say, supposing 40 lbs. of sulphate of alumina and potash be employed, only 2 lbs. of chloride of sodium will be required, and from 10 to 12 lbs. of mimosa catechu;—place them in a flat vat, and treat them in the same manner as is required for the manufacture of Hungary leather,—having previously soaked them only a sufficient time to produce a uniform color, free from stains or spots. When the above-described operations are completed, the skins are to be left in the above-mentioned solutions; and, at the expiration of seven or eight days, 60 lbs. of mimosa catechu (in solution) are to be added. At the end of about twenty days, during which time the skins must be occasionally raised, they must be laid in the tan-pit, as already mentioned. The quantity of bark employed will be about 30 lbs. for each skin.

In conclusion, the inventor remarks, that the operations, above described, being of a novel character, both in science and manufacture, he will designate the process for treating soft leather, *megisso-tanning*, and, for hard leather, *Hongroyo-tanning.*

The patentee claims the manufacture of leather by effecting the tanning operation in the following manner, viz., by employing substances which act immediately upon the albuminous matter of the skins (such as sulphate of alumina, sulphate of alumina and potash (alum), chloride of sodium, chloride of potassium, the sulphates of soda, potash, or magnesia, chloride of zinc, or of aluminium, &c., either alone or in mixture, and perfectly neutral; sulphite of soda may also be employed), in combination with substances containing tannin, and intended to act upon the gelatine of the skins (such as mimosa catechu, the bark of various kinds of oak, and also their leaves and fruit, the bark of the beech, poplar, chestnut, birch, maple, spurge-laurel, sumach, &c., and, in fact, any substance containing tannin); which matters, containing tannin, must be

employed in proportions varying according to their known richness,—taking, as a standard, mimosa catechu, of good quality, which contains about 50 per cent. of tannin, and which is to be employed in the proportions set forth in the body of the specification.—[*Inrolled May,* 1850.]

To JOHN TORKINGTON, *of Bury, in the county of Lancaster, railway contractor, for certain improvements in the construction of chairs for railways.*—[Sealed 12th October, 1849.]

THE object of this invention is to obviate the serious inconveniences which result from the yielding of the rails at the joinings or points where the different lengths of rail meet or cross, during the passage of trains over the same; and it consists in certain improvements in the chairs used for supporting such rails, whereby the patentee produces what he calls the "uniformly-supporting joint chair."

In Plate XV., fig. 1, is a longitudinal elevation of the improved chair; fig. 2, is a plan view thereof; fig. 3, is an end view; and fig. 4, is a tranverse section taken at the centre of the chair. It consists of an iron rib or beam *a,* about three feet long, on the upper side of which three holders or chairs *b, b,* b^1, similar in form to the ordinary chairs, are cast; and the rib or beam rests at each end upon a transverse sleeper *c,* to which it is secured by spikes or trenails *d, d.* The top of the rib or beam serves to support the ends of the two adjacent rails *e,* e^1, which meet at the centre of the middle holder or chair *b,* and are secured there by the insertion of a key or wedge *f*; and similar keys or wedges are driven into the two end holders or chairs *b, b*: the bearing of the ends of the rails on the chair, which now seldom exceeds two inches, is thus increased to about eighteen; and there will consequently be a proportionate increase in the unyieldingness of the rails under pressure and in the steadiness of the carriages passing over them. This arrangement is stated to combine all the advantages of the longitudinal system of laying sleepers with those resulting from the employment of transverse sleepers or blocks.

Instead of the holders or chairs *b,* being cast in one piece with the rib or beam *a,* they may be cast separately, and afterwards secured thereto by inserting their bases (which are suitably formed for the purpose) into dovetail recesses in the top of the rib or beam, and then driving in the wedges *g.*

In place of only three holders or chairs being cast on or attached to the rib or beam *a*, the number may be increased to five.

The patentee claims, Firstly,—the giving to the ends of the rails, by means of the "uniformly-supporting joint chair," a greater length of bearing on the chairs than has heretofore been done. Secondly,—the distribution, by means of the said chair, of any pressure coming upon the joints over two sleepers at one and the same time. Thirdly,—the securing the ends of two adjacent rails, by holders or chairs, at three or more places on one rib or beam, as above described.—[*Inrolled April*, 1850.]

To WILLIAM BRINDLEY, *of Nelson-terrace, Twickenham, papier-maché manufacturer, for improvements in producing ornamental designs on papier-maché, and in preserving vegetable matters.*—[Sealed 17th November, 1849.]

THE first part of this invention consists in an improved mode of producing ornamental designs on papier-maché.

The patentee takes the sheets of wet paper, as they come from the sieve, and places them one upon another until he has obtained the desired thickness; then, before pressing them, he places the accumulated mass of sheets upon the oiled pattern, and lays a sheet of waterproof paper (oiled paper) on the top thereof, and on it several more sheets of wet paper; after which he subjects the whole to pressure; and then he clamps the whole together and stoves the same. The object of applying the wet paper to the pattern (before being pressed) is in order that such materials as leaves and flowers of plants and trees may be used as the pattern surface or part of the pattern surface: which materials, being very delicate, would not admit of the "green" paper being used after being pressed. In preparing the pattern surface, the patentee prefers to employ panel board, on which he places the leaves or flowers of plants or trees (such matters being well oiled), and then on them he lays the sheets of wet paper.

The second part of the invention consists in an improved method of preserving vegetable matters, such as the leaves, stalks, and flowers of plants, by oiling them, and then placing the same between sheets of paper and stoving them in the same manner as articles made of papier-maché: the patentee employs a temperature of from 250° to 300° Fahr.

The patentee claims, as his invention, Firstly,—the producing ornamental surfaces on papier-maché by employing unpressed wet paper; and also the employment of the leaves of plants or flowers, or parts thereof, in making ornamental surfaces in papier-maché. Secondly,—the preserving of vegetable matters, such as the leaves, stalks, and flowers of plants. —[*Inrolled May*, 1850.]

To William Gilbert Elliott, *of Blisworth, in the county of Northampton, Gent., for improvements in the manufacture of bricks, tiles, and pipes, and other articles, from plastic materials,—being a communication.*—[Sealed 27th April, 1850.]

This invention consists in manufacturing bricks, tiles, pipes, and other articles, from clay and other plastic materials, by melting or fusing such clay or other plastic material, and running it into moulds of the shape of the articles required to be produced.

The clay, as it is dug from the pit, if sufficiently dry, is at once conveyed to an air or blast furnace, wherein it is brought to a state of fusion; and then it is run into the moulds, which should be as close to the furnace as possible; for the melted clay should be introduced into the moulds at a high degree of heat; as it will not bear to be conveyed in ladles or run through troughs into the moulds. The moulds may be made of iron or other suitable material; and the patentee prefers to carry the moulds to and from the furnace by means of an endless wire web or band, which moves beneath the furnace, and thus brings the moulds close to the opening from which the fused clay is discharged.

Bricks, paving blocks, slabs, tiles, drain and other pipes, window sills, wall plates, mantel-pieces, copings, culverts, cisterns, or any other articles capable of being moulded from plastic materials, may be made in the manner above described; and they will be ready for use when cold; but care must be taken to protect them, while cooling, from the action of a damp atmosphere.

The patentee claims the melting or running of clay and other plastic materials, when in a state of fluidity or fusion, into moulds or casts of the shape of the different articles to be manufactured, as above described.—[*Inrolled May*, 1850.]

To William Wyatt, *of Waterloo Cottage, Oldswinford, in the county of Worcester, pump-maker, for improvements in coating the surfaces of pumps; pipes, cisterns, and other articles of iron.*—[Sealed 18th October, 1849.]

This invention consists in coating cast iron pumps, cast iron pipes, cast iron cisterns, and other articles of cast iron, with a glass or glaze.

The glaze is composed of lead, borax, and silex, which are combined in the proportion of three parts, by weight, of white lead (or one part of red lead and two parts of white lead), two parts of borax, and one part of calcined flint. These ingredients, being well mixed together, are to be fused in a crucible, run into water, and then ground with water in a glaze mill; and when the mixture is thoroughly reduced, so that it will readily pass through a silk or lawn sieve, such as is used by china manufacturers, it will be ready for use: it is not absolutely necessary to fuse the materials; but it is better to do so. The glaze thus prepared, being about the consistence of cream, is applied to the inner surfaces of pump barrels, pipes, and similar articles of cast iron, by closing one end, introducing a quantity of glaze, turning the article round, so as to coat the interior uniformly with the glaze, and then pouring out the surplus. The interior of cisterns and like articles of cast iron is coated in a similar manner, by introducing a quantity of glaze and moving the article about in various directions until the interior is uniformly coated. In general it will only be necessary to scour and wash the surface, previous to coating; but if the surface is much oxidized, it is requisite to subject the articles to a red heat, and, when cool, to scour them well with water. It is preferred to warm the metal before the application of the glaze, in order to facilitate the drying of the latter. The exterior surfaces of articles of cast iron may be coated by dipping the articles into the semi-fluid glaze, or by applying the glaze thereto with a brush.

After the pumps, pipes, cisterns, or other articles of cast iron have received a coating of glaze, they are to be subjected to a suitable temperature for firing the glaze and thereby causing it to adhere. This is effected by placing the articles in a kiln heated in such manner that no flame or sulphur shall come in contact with the articles. The heat is gradually raised until the glaze melts (which can be seen by taking out a brick from an opening in the kiln); and, so soon as the melting of the glaze takes place, the fires are drawn, and the

articles are allowed to cool: when the articles have become cool, they are removed from the kiln, and are ready for use.

The patentee does not confine himself to the precise quantities of the matters above mentioned, nor to the precise details of the above-described process; but what he claims as his invention is, the coating with a glaze, such as above explained, the surfaces of cast iron pumps, cast iron pipes, cast iron cisterns, and other articles made of cast iron.—[*Inrolled April*, 1850.]

To ANDREW CROSSE, *of Gloucester-place, New-road, in the county of Middlesex, Gent., for improvements in tanning hides and skins, and also in dyeing fabrics and substances.**—[Sealed 24th May, 1849.]

THE first part of this invention consists in the application of hydrosulphuret of lime in the process of unhairing hides and skins, by causing the hides and skins to be moistened with and soaked in hydrosulphuret of lime (which is obtained by passing sulphuretted hydrogen through a mixture of lime and water), whereby the hair will be quickly loosened, and may then be removed in the ordinary manner.

The second part of the invention consists in a mode of obtaining strong tannin or other matter from bark, or other substance used in tanning or manufacturing hides and skins into leather. The pulverized or ground bark, or other substance, is first permitted to absorb so much water as may serve to dissolve or set loose the tannin principle or other matter held within the bark or other substance; and then it is subjected to powerful pressure, by means of an hydraulic press or other suitable mechanical apparatus, which causes it to emit an ooze or tanning liquid of a strong kind, *i. e.*, without so great an admixture of water as may be found in tanning liquid produced by the ordinary method of immersing and soaking the bark or other substance in pits. The improved process is to be repeated upon the same bark or other substance until it no longer contains any tannin or useful matter.

The third part of the invention consists in obtaining electric or galvanic effects in the pits or vessels in which hides and skins undergo the process of tanning. On one side of the pit or vessel is placed a plate of lead, and on the other side a plate of zinc (the plates covering the sides of the pit or vessel); and the two plates are connected together at the

* The patentee has, by means of a disclaimer, struck out the words "and also in dyeing fabrics and substances" from the title of his patent.

upper parts of the same, above the tanning liquid, by means of a strap of either of those metals. The hides or skins, after being unhaired, are suspended in the pit or vessel, which is to be filled with water; the water is allowed to remain therein for three or four days, and then it is either to be removed or else converted into tanning liquor by the addition of bark or other suitable matter; or, the water having been removed, the pit is to be filled with tanning liquor, which is to be kept at the strength of about fifteen degrees of a saccharometer for the first week, and after that the strength is to be increased at the rate of six degrees per week, until a strength of about forty-six degrees is indicated, which is to be maintained until the completion of the tanning process. The patentee says that he does not confine himself to the strengths of the tanning liquor, nor the progressive increase of the strengths above mentioned; and he states that the means of obtaining the requisite electric or galvanic effects in the pit or vessel may be varied.

The patentee claims, as his improvements in tanning hides and skins, Firstly,—the subjecting hides or skins to the action of hydrosulphuret of lime. Secondly,—the improved mode of producing tanning liquid. Thirdly,—the employment of means to obtain electric or galvanic effects in the pits or vessels in which hides or skins are under process of tanning.—[*Inrolled November,* 1849.]

Scientific Notices.

PATENT AGENCY AND ITS PROFESSORS.

Q. Is the object of the present practice [of granting patents] to encourage the employment of patent agents, and to discourage the employment of counsel before the Attorney-General?

A. I am told that that is the effect. * * * * The official difficulties are such as practically to exclude inventors from getting their own patents, and to compel them to employ patent agents. * * * * The London patent agent is a very mixed person,—in some cases simply a solicitor of patents, —in others he is an adviser upon patents,—and there are instances in which a party combines the two [branches]. * * * * Therefore it is a very mixed sort of body; you have every class of persons. The fact is, that patent property has become of enormous value within the last few years; and therefore it is altogether a new system that has been engrafted upon the old; and it has called forth a class of men that occupy an intermediate position, and a class that never existed before.—Mr. T. Webster's *evidence before the Committee on the Signet and Privy Seal Offices.*

Mr. Editor,

I have read, with considerable interest, the papers which have appeared in your Journal, from time to time, relat-

ing to Patent Law Reform, and other matters which affect the interests of inventors and manufacturers generally, and, being assured in my own mind of the honesty of your desire to secure the welfare of the ingenious men to whom your work is particularly addressed, I am somewhat surprised that you should have failed to remark upon the position in which they stand with regard to a class of practitioners whose doings are most potent to them, either for good or evil,—I allude to that comparatively recent self-instituted amphibious body (half lawyer half man of science) yclept "patent agents." But perhaps I am somewhat unreasonable in supposing that you would volunteer to stir an enquiry which might raise something more than a doubt as to the correctness of the procedure of some members of a profession with which you are connected; I trust, however, that no fastidious reserve will induce you to refuse publication to the remarks of one who is not altogether ignorant of the duties and responsibilities attendant on your laborious profession, and who, while he is desirous of seeing its respectability maintained, feels no repugnance to take the initiative in an enquiry which demands the earnest attention of inventors and patentees, and is not without interest to the community generally. As a text for my comments, I may state that I have chosen what may be deemed a trustworthy authority, if intimate knowledge of the matter in hand goes for anything; and, without further preface, I will now proceed to the consideration of my subject.

In most civilized countries, where the rights of the community are wisely cared for, it has been considered politic by the governing powers, to put some effectual bar to the admittance of incompetent and disreputable persons into the learned professions, and to provide a means for suspending and expelling beyond the pale such as might bring discredit upon themselves, without becoming amenable to the laws of the land. Even in this country, where monopolies are so jealously regarded, prudence has dictated the application of a test, not merely for the candidates for institution into those societies whose duties are respectively to administer to the bodily and spiritual maladies of mankind,—but also for permission to practice as guardians and advocates of the legal rights of individuals; such only being admitted as by a suitable course of studies have qualified themselves for the work: the advantages of this arrangement are unquestionable. With respect, however, to the profession of patent agency, the duties of which are much akin to those of solicitors, and certainly as onerous, there is no bar to any man taking the "cloth," whatever his

deficiencies, whether in character or ability; and only one check (and that a very slight one) to his establishing a practice,—to wit, the *prudence* of the public. But, if Mr. Webster be correct in his statement before the Committee on the Signet and Privy Seal Offices, that "the official difficulties are such as practically to exclude inventors from getting their own patents, and to compel them to employ patent agents," it is obvious that some protection ought to be given to intending patentees, by ensuring that all who act in the capacity of agents should, at least, possess the limited qualification of a reputable character; and it is to be hoped that this point will not be overlooked, if the legislature should ever deign to remodel the existing patent laws. Before, however, any act is passed to render a qualification necessary for practising as a patent agent, much mischief may and will be done to patentees by speculators in their credulity. It behoves them therefore to be somewhat wary into what hands they trust their inventions and their monies, both of which might be made available for other purposes than their rightful owners desired. This is the more necessary, as any scheming genius, whose profession is to live by his wits, has merely to procure for himself "a local habitation and a name" (the former of which he may obtain through the gullability of some silly landlord, and the latter through the advertising columns of a newspaper); and, by the purchase of some five shilling essay on patent law, or, perhaps, a second-hand blue book referring to parliamentary returns on the subject, he will be in possession of every external requisite to enable him to follow the calling of a patent agent. Started in this way, many have suddenly risen into notice, battened awhile on the harvest which they gathered, and have as suddenly and as mysteriously disappeared; leaving their unfortunate victims to mourn their unpardonable folly in trusting men of whose ability and integrity they knew nothing. But, Sir, it may be asked—How is an inventor, who, for the first time, seeks the protection of the patent laws, to discern between the man of integrity and skill, and the mere charlatan? I will not attempt to lay down an infallible rule for his guidance in this Diogenesian search, but I would simply beg him to consider how he proceeds in the selection of a physician, or an attorney, when he requires such professional assistance; and then I would bid him go and do likewise in his choice of a patent agent. If he has a *penchant* for advertisers, by all means let him follow that course in the present instance.

There are, however, some men who have been so peculiarly blest as never to have required the advice of either the pro-

fessor of law or physic. Now it will be evident that the freedom from cares which this blessing indicates necessarily involves, on the part of its possessor, an amount of inexperience in the world's ways which renders him peculiarly liable to become ensnared by that section of patent agents designated, I believe, as "the mushroom class." I will therefore, by your permission, attempt a sketch, for his especial use, of the patent agent proper; which will, I hope, enable him to apply the picture and save himself from the risk of obtaining dear-bought experience. This functionary (to draw an ideal character) is one man picked out of ten thousand. He is made up of contrarieties. Possessing a fair share of literary attainments, he never, in his writings, attempts euphony or elegance of expression, but sticks to the dry methodical stereotyped phraseology and arrangement of specifications. He is a lawyer, and a profound one, as far as his pretensions go. He sets at nought, with perfect nonchalance, the opinions of counsel, if opposed to his own; and not unfrequently denounces the ignorance displayed in patent causes by the judges. He is a man of science, but a very shallow one; his knowledge is wholly superficial,—but, for its extent, no man can compare with him. There is no branch of manufacture which has not, at some time, received his earnest attention; and, whether bearing upon chemistry or mechanics, he has been enabled fully to grasp its details: in fact, there are few manufactures in which he will not perceive the want of something which is employed in some other branch with which he is familiar. His ignorance is often transparent, and yet his knowledge is marvellous; for, being the first recipient of new inventions, he is necessarily possessed of information which is quite new to the world at large: in detecting a fallacy he is particularly acute. He will often find difficulty in comprehending an inventor's improvements, and, before the close of the interview, will give him far clearer notions of his own discoveries. He is a kind of human telescope, seeing things far ahead which others never dreamed of. This power he will exhibit during his first interview with the inventor, by suggesting, when drawing the title for a patent, applications for the invention never contemplated by his client, but of which he is not unwilling to avail himself. His faculty of looking ahead is also in like manner displayed in constructing the claims of a specification; for, if he is fortunate enough to come across a new principle, he will by no means let it slip through his fingers; but at once appreciating it as a high road to great results, he will enter a claim to the property, and cause all

who travel in that direction to pay their proper dues for the convenience: this is, perhaps, his most valuable quality, as by it he puts a purse at once into his client's hands, instead of leaving him (as he might be left) to break stones on the highway which he had opened out. It has been somewhere remarked, that the specification is the patentee's title-deed;—of the truth of the remark there can be no doubt; for by the construction of that document his rights must stand or fall; it is therefore in the preparation of the specification—the "great responsibility" of the patent agent—that his full powers are called forth. He then demands, and will accept no less than the pilot's privilege of steering through the shoals and breakers [*id est,* prior inventions partly anticipating the one in hand] which beset his course, according to his own judgment. As a principle he will never take a pecuniary interest in inventions, although few are better able to determine their real value, or more likely to meet with good bargains; and, being an adept at fencing patents, so as to protect them from piracy, he has the keenest scent for discovering a flaw or oversight in another's work, and will, if occasion require, make use of that important faculty.

This Sir, is my sketch of the "very mixed person," as Mr. Webster terms the patent agent,—the type (or rather what should be the type) of a class of men that has been called forth by the recent increase in the value of patent property. I feel that I have done little justice to the skill of these men by whose exertions alone (without the aid of Parliament) patent law has been changed from an oppressive to a protective system; but that was not my object. If my remarks have served to shew that great experience—and that, in a certain degree, of a practical character—combined with a large share of sagacity, are essential to the formation of the patent agent, it is evident that he must be an animal of a slow growth—that he cannot be "raised" in a corner and unknown to the manufacturing world—that a knowledge of his history is as essential to the inventor as the lineage of a blood-horse is to the jockey—and that, in fact, the true man possesses certain characteristic "points" which should prevent his being confounded with the mere pretender. To give prominence to these facts was my object in addressing you; and, should my communication have the effect of preserving but one inventor from dishonest hands (the mushroom class), I shall not think my labor lost; nor will you, I trust, regret having opened the pages of your Journal to the lucubrations of

A PATENTEE.

Academy of Sciences, Paris.

REPORT UPON THE TELEGRAPHIC APPARATUS OF M. SIEMENS, OF BERLIN.

THE telegraph presented by M. Siemens to the Academy is of the kind known as alphabetic telegraphs. Telegraphs of this nature have hitherto been constructed and worked upon the following principle:—The two stations (Paris and Berlin for example) between which communications are required to be made, are united by two insulated wires, which are either stretched across posts, set up at about 50 yards apart, or enclosed in a durable non-conducting material and buried in the ground. If a battery be established at Berlin, having its positive pole in communication with one of these wires, and its negative pole with the other, this is not sufficient to establish a current; for the circuit will be broken at Paris,—the ends of the two wires not being in communication. But, if the circuit be closed at Paris, by joining the two wires, or uniting them by any conducting material, the current will be immediately established,—and the electric fluid will circulate permanently throughout the wires, as well as through the apparatus by which they are united. In this arrangement, it is stated, in common parlance, that the fluid travels from Berlin to Paris by the wire which communicates with the positive pole of the battery, and returns from Paris to Berlin by the wire which communicates with its negative pole. Care must however be taken not to construe, literally, the received expressions which denote coming, returning, and circulating; for by them it is not meant that the electric fluid really circulates, or that it undergoes a movement of transmission analogous to that of a liquid flowing through a tube, or of gas passing from a gasometer to the burner,—they only mean, that the effect of the electric fluid is felt at the different points of the circuit. When, for instance, sound strikes an echo and rebounds to its starting point, it may be said that it has a backward and forward or a circulating movement; and yet we are well aware that, in reality, the air does not travel from the point where it is disturbed to the surface forming the echo, and thence back to the starting point,—for, instead of travelling, the air merely vibrates, and these vibrations are successively transmitted from one to another with a certain speed; it is, therefore, the action and reaction of the primary impulse which is transmitted, and not the fluid itself; or, in general, the medium which receives the impulse: this must be understood, when speaking of the transmission of the electricity, in the same manner as when speaking of the transmission of sound or of light. The electric current circulates, therefore, from Berlin to Paris, and from Paris to Berlin, on the condition, 1st, that the battery furnishes electricity; 2ndly, that the wires are properly insulated; 3rdly, that

the circuit is complete at all points along the line of communication. If the wires should happen to communicate electrically with each other,—if, for instance, they are united by a fine wire, or by a stream of water, or by damp, or by any other conducting arc, this conducting arc instantly becomes the seat of a derived current, which weakens, in a certain degree, the remaining portion of the circuit.

Theory allows the intensity of a current to be calculated throughout the various portions of its circuit, thus ramified in the most complicated manner, provided all the elements of these ramifications can be arrived at.

Theory has also pointed out a doubly-economical method of establishing a circuit between two distant points, such as Berlin and Paris;—this method consists in dispensing with one of the wires, and using the earth itself as a medium of communication. Let us suppose, for instance, that there is only one wire stretched between these two points, and that at Paris its extremity communicates with the earth by means of a large plate of metal, immersed in the Seine, or even in a well,—and that the negative pole of the battery communicates also with the water of a well, and, consequently, with the waters of the Spree: it will be understood that, immediately the positive pole touches the extremity of the wire, the current will, as above stated, come from Berlin to Paris by the wire; but, instead of returning to Berlin from Paris by another wire, it will return through the waters of the Seine, the North Sea, the Elbe, and the Spree, and also through such portions of the earth as possess sufficient conductibility to allow of its passage. It is then said that the earth forms a portion of the circuit; and thus a double economy is effected,—first, by avoiding the expense of a second wire; and, secondly, inasmuch as the earth, from the great space which it offers to the current, opposes to its progress much less resistance than a second wire.

We will add a few words respecting telegraphic signals:—As the current, which passes continuously through a circuit (formed by two wires, or by one wire and the earth) only produces a constant and uniform effect, it is not well adapted for producing the necessarily varied signals which are required for the expression of various ideas. It is therefore requisite to obtain from the current different effects, and to combine them, until a number of signals are obtained, sufficient to reproduce all that is required to be expressed. This is effected in a very simple manner, by interrupting the current and again re-establishing it, and so arranging the apparatus as to cause this alternating action to give rise to a backward and forward movement of greater or less rapidity. For this purpose, an electro-magnet is introduced into the circuit, which becomes a magnet during the passage of the current, and loses that property immediately the current is interrupted. So long as it is magnetic, it attracts its armature, which is drawn back by a spring when its attractive power ceases;—thus

the armature is caused to oscillate or vibrate between the magnet and the spring. These vibrations may be caused to take place with almost inconceivable rapidity,—as it is very easy to construct an apparatus capable of producing several hundred in a second; and there seems no reason to doubt that this number might be increased tenfold. It will be seen, however, that there is one condition absolutely necessary for this purpose; viz., a due proportion between the power of the spring and that of the electro-magnet: the power of the latter depends upon various conditions, but more especially upon the intensity of the current. An alternating motion being obtained, of the required speed and regularity, it is easily converted into rotary motion, whereby a needle may be made to travel round a dial upon which the letters of the alphabet or other conventional signs are marked. To enable the letters to be read, it is sufficient to cause the needle to stop for a very short time (a quarter of a second, for instance) opposite any particular letter;—words are thus formed, and have merely to be taken down as fast as the telegraph acts. In this way, each single oscillation might be made to correspond to a letter on the dial; it is, however, generally thought more advisable to arrange the apparatus, so that one letter should be passed at every double oscillation only:—thus, supposing there are thirty signs upon the dial, thirty double oscillations of the armature will be requisite to enable the needle to travel right round the dial. By this means, the needle is only stopped for an instant at the end of the double oscillation,—that is to say, whilst the armature is under the action of the spring, and not attracted by the magnet.

It now remains to explain the manner in which the operator at Berlin, on transmitting his message, interrupts the current with the required speed and regularity; and how he is enabled, with certainty, to stop the needle at the other station, viz., at Paris, exactly at the required letter. For this purpose, he has an *interrupter*, viz., a wheel of, say, 60 centimetres in circumference, and divided into 60 equal parts: these divisions, forming a cylindrical surface on the periphery of the wheel, are alternately of metal and ivory, *i. e.*, conductors and non-conductors; and, opposite these non-conductors (thirty in number), thirty signs, employed in the telegraph, are arranged in the same order as on the dial at Paris. The two ends of wire, which are to come in contact to complete the circuit, are made to bear against the periphery of the interrupter,—both ends being upon one of the divisions of the wheel: when they come opposite a metal division, the circuit is complete, and, consequently, the current is in action; but, when an ivory division comes under the wires, the circuit will be broken, and, consequently, the current will be interrupted. Thus, if the operator turns the wheel by hand one entire revolution (commencing with an ivory division), it is certain that the circuit will have been thirty times broken and completed, and that the electro-magnet will have been thirty times converted into an electro-

magnet, and thirty times deprived of its power; the armature will have made thirty double oscillations, and the needle will have made an entire revolution round the dial, in the same manner as the interrupter at Berlin. If the two accorded, *i, e.*, if they corresponded with the same sign or letter on commencing, they would agree at the conclusion; and nothing can be easier than to cause them to correspond. Each station must be furnished with the two kinds of apparatus above described, viz., the interrupter for transmitting the message, and the dial for receiving it: there is also a third apparatus, called the alarm bell, which is only introduced into the circuit when the correspondence is stopped, but which enables the party desirous of sending a message to signal the party at the other station.

All alphabetical telegraphs, constructed previously to M. Siemens', are upon the above principle; and they may be characterized generally, by stating that they are provided with an interrupter worked by hand by the party sending the message, and that, consequently, the party receiving it is obliged to remain passive until his correspondent allows him to speak;—and that, although various kinds of apparatus have been employed, the only variations have been in the methods of converting the reciprocating into rotary motion; or in the arrangement of the dial, or the form of the interrupter, or the number of its divisions.

M. Siemens has effected a most important advantage in the arrangement of alphabetic telegraphs, by means of which the party receiving the message can, at the same time, communicate with the other party without having recourse to a second wire, or in any way disturbing the arrangement of the apparatus or interrupting the delivery of the message. For the purpose of enabling a party, while receiving a message, to communicate with the party sending it, in order to correct an error or have an imperfectly understood signal repeated, &c., M. Siemens entirely dispenses with the interrupter, and arranges his dial-apparatus in such manner that it shall act precisely in the same manner, whether sending or receiving a message. We will endeavour to give an intelligible description of this ingenious apparatus, which acts with great speed and perfect regularity. The armature of the electro-magnet is provided with a lever, about an inch in length, which produces two very different actions. The effect of the first is, at every double vibration (backwards and forwards), to drive forward the wheel, which is mounted upon the shaft of the needle or indicator, the distance of one tooth, and, consequently, carries the needle forward a letter. By the second action it breaks the circuit and stops the current from which it has itself received its motion; but not until it is itself stopped in its forward motion, *i. e.*, when the armature, attracted by the electro-magnet, has approached as near the poles as possible: the circuit being then broken, the armature ceases to be attracted, and being immediately drawn back by its spring, the lever returns to its former

position. By this means the circuit is again completed, and the current re-established; and the lever is immediately carried forward again by the armature, to return again as before. These isochronal vibrations would proceed for an indefinite period, as long as the battery furnished a current of equal intensity; but they would become slower as its power diminished, and finally cease when the action of the current became too weak to endue the temporary magnet with power sufficient to overcome the inertia of the armature and the tension of the spring which holds it back from the poles.* Two similar apparatus of this kind introduced into the circuit, one at Berlin and the other at Paris, would work with perfect synchronism (excepting the speed of the electricity, which need not be taken into account); and if they were in accord at the commencement, *i. e.*, if the needles corresponded with the same sign, they would make thousands of revolutions, and would work for days and even years in concert; that is, they would always, at the same instant, be opposite similar signs: this apparatus derives its motion entirely from the battery. The indicating-needle would, however, have a regular movement, like that of the second-hand of a watch; but it would be more rapid, as it might be made to move an entire revolution in a second, taking only the thirtieth part of a second to travel from one sign to another,—supposing the lever of the armature to make thirty double vibrations per second. M. Siemens has, however, only tried his apparatus at one half this speed, viz., a revolution every two seconds, or a double vibration of the lever of the armature every fifteenth part of a second. This does not imply that his needle will indicate fifteen signs per second or nine hundred per minute, for the eye could scarcely follow the needle; besides, with this regular and uniform jerking motion, it shews all the signs equally, and produces the same effect as if it indicated none; as the observer cannot distinguish anything or follow its movements. The same effect is produced as if a person were to recite the alphabet several times over in a perfectly monotonous tone, without laying emphasis upon any particular letter;—it would be utterly impossible to distinguish what he had been saying. Something still remained, therefore, to be added to the above apparatus; the needle must be stopped in its course, not for a long time, but during half a second, or perhaps only a third or a quarter of a second, according to the quickness of the movements of the

* In 1843, M. de la Rive augmented the chemical action of a simple element by introducing into the circuit an electro-magnet, the armature of which, by its slow vibrations, effected successive ruptures. In 1846, M. Froment, applying the same principle under another form, caused the armature of an electro-magnet to vibrate with sufficient velocity to produce very sharp sounds (*Comptes Rendus*, *Vol. XXIV.*, *p.* 428). At the same period, M. Froment employed these vibrations as a motive power, after having added to his apparatus a mechanical arrangement, capable of being regulated at pleasure; and which broke the circuit at any required period.

parties sending and receiving the message: by this means the needle would point out the letter to which it is required to direct attention. To obtain this result, M. Siemens has placed around his dial as many stops as there are signs, and upon each stop the sign to which it belongs is legibly marked. On pressing the finger upon any one of these stops, a small vertical rod of one or two-thirtieths of an inch in diameter is depressed; which rod acts as a stop to a horizontal lever parallel to the needle and mounted on its axis. This has exactly the same effect as if the needle itself were stopped, but the mechanism is hidden under the dial, in order not to distract the attention of the operator. It is not sufficient for the needle to be stopped exactly opposite the sign it is intended to indicate; it is important that the motive lever affixed to the armature, the vibration of which is arrested by the same obstacle, should then be midway in its return-motion, which is caused by the action of the spring.

The person sending a message has therefore only one operation to perform, viz., to lay his finger successively upon the stops corresponding to the signs he is desirous of transmitting, and, when the needle comes round to the sign (the stop of which is depressed), it will stop. The needle at the other station, although its motion is synchronical, will not stop at precisely the same instant, as the lever which moves it, being also drawn back by its spring, is obliged to return,—as it does not, like the other one, meet with any bodily obstacle to its progress; it therefore completes its return-motion, and assumes the position required for completing the circuit and re-establishing the current. This, however, cannot take place immediately, as the needle at the other station is retained in a position in which it breaks the circuit. Thus the operator, who is sending the message, by placing his finger upon a stop for a fraction of a second, gives a sudden check to the movement of the needle at the other station; but it must be remarked, that the two needles cannot stop at the same instant; the second is not arrested until the expiration of about a quarter the duration of a complete duration. This circumstance is important, from the influence it exerts upon the number of signs which may be transmitted in a given time.

Upon the person, who sends the message, raising his finger from the first stop, in order to act upon another, the following actions will take place:—The lever of his apparatus, obeying the action of its spring, is free to complete its return-motion, which it does. The circuit being thus completed, the current will be re-established; the armatures of the two stations are simultaneously attracted, and the needles resume their progress until the next stop is depressed: this will act on the needle of the other station, and the action will be repeated as before. The person receiving the message has only attentively to follow the movements of his needle, and write down or dictate the signs which it indicates; but if he is in doubt or difficulty, he lays his finger

upon a stop, and thereby arrests the movement of the needle at the other station; he will thus be enabled to communicate with the other party and clear up the difficulty; after which, the transmission of the message may be resumed. It will be understood that by this apparatus the communication will assume the nature of a verbal conversation, in which each party can put in his word.

The apparatus, of which an idea is given above, does not require any auxiliary; but in that case reliance must be placed upon the correctness of the party receiving the message. To provide, however, against the effects of negligence, M. Siemens has arranged a magnetic printing apparatus, by means of which the message may be as well printed as by a press. When this is used the person receiving the message has nothing to do while his apparatus is at work; but at the end of the operation he will find a strip of paper upon which the letters of the message are accurately printed, with a larger space between the words than the letters. It might even be correctly punctuated, to render the text intelligible; but, for ordinary communications, this will be quite unnecessary.

The printing apparatus, which is at once ingenious and effective, is constructed in the following manner:—A vertical shaft, precisely similar to the shaft carrying the needle, and receiving rotary motion by means of precisely similar mechanism, carries at its upper part thirty horizontal radiating arms, set in the same plane at equal distances apart; and on each of these arms, near the end furthest from their axis, at their upper part, is a letter in relief. These arms are flexible,—and as they act in the same manner as springs, it will be sufficient to drive them upwards against the fillet of paper a little above them, and make them press against it with a suitable amount of force. This fillet of paper passes round about half the circumference of a printing-roller provided with printing ink, which is only communicated to the paper at those parts where the arms carrying the types are made to strike,—at which parts the letters will be clearly printed.

There are, however, peculiar arrangements of mechanism, for the purpose of fufilling the two following conditions, viz., 1st. To enable the printing-roller (which must be stationary at the moment of printing) to turn and carry the paper round a suitable distance, for the purpose of producing a blank space, as soon as it has received a letter, and a larger space when a word is completed. 2nd. To enable the hammer which strikes the letter underneath to do so at the precise moment when this latter stops to receive the blow.

It has already been said that the arms which carry the letters in relief receive motion in the same manner as the needle; *i. e.*, they themselves form a kind of revolving dial; so that all the

letters come in succession under the hammer, which is a fixture. The party also who sends the message can, by pressing upon a stop, arrest, for an instant, a type at the other station in the same manner as he stops the dial-needle at any particular letter. It now remains to explain how the hammer is caused to act during that instant. This is effected by means of a powerful electro-magnet, worked by a separate battery, the current of which is, of course, distinct from that of the telegraphic circuit. Each time that the motive lever of the telegraph performs a vibration and passes a type, it establishes a communication between the poles of the auxiliary battery, or, in other words, it completes the circuit of the printing electro-magnet;—this latter, however, does not act immediately, as it is constructed so as to be affected more slowly by its current; but, when the motive lever stops for an instant under the action of its spring,—that is to say, at the limit of its return, in order to repeat the sign which the other station had transmitted,—the printing electro-magnet receives from the current which passes through it sufficient power to actuate the heavy armature. By this movement, it produces the following effects:—1st. By means of a long lever attached to it, the hammer is caused to strike the type or letter. 2nd. By a second lever, which acts a little later on a ratchet-wheel, the printing-roller, with its fillet of paper, is turned the extent of one ratchet-tooth: this roller has also a longitudinal movement, in order to enable the whole surface of the paper to be printed upon. 3rd. By means of a third lever, the circuit of the auxiliary battery is broken; and thus the power which actuated it is destroyed, and the lever is instantaneously drawn back by its spring. 4th. By means of a fourth lever, which only acts at the completion of each word, the armature of the printing electro-magnet strikes a bell, and thereby signals to the parties at the opposite stations whether their apparatus agree. This action is effected by an ingenious arrangement:—each word is terminated by a blank stop; and the arm corresponding to that stop has no letter upon it; the hammer, therefore, on striking, not meeting with any resistance from a letter in relief, makes a rather longer stroke, and allows the armature, to which it is attached, also to proceed further. By this means, the bell is struck by the fourth lever at the end of each word only,—it being silent while the letters are being printed.

M. Siemens has also adapted an apparatus which he calls a *transmitter,* which is only intended to transmit messages between two very distant stations. This apparatus is on the same principle as the above; but, besides this, it presents an interesting application of the theory of derived currents. The current which circulates between the stations (properly called the telegraphic current) may be very weak, as scarcely any effort is required of it;—its only function being to open and close the circuit at the proper time. The currents from the batteries of the respective

stations, then passing almost exclusively into the signal apparatus, will possess sufficient power to work them; and, when their office has ceased, the weak telegraphic current will act in its turn to prepare the apparatus for the next signal.

The Commission have examined M. Siemens' apparatus with great interest, and remarked throughout an evidence of a perfect intelligence of the theory; as M. Siemens appears to have taken into account all the complicated phenomena which are manifested in the conductors and electro-magnets, especially when the actions are of short duration.

M. Siemens' system, if worked with care and attention, appears to possess incontestable superiority over all other apparatus of the like nature,—that is to say, the ordinary arrangements of alphabetic apparatus; as the latter do not work with the same degree of precision and accuracy. With regard to speed, the Commission are led to believe that M. Siemens' apparatus surpasses all other alphabetic apparatus; their opinion is also that M. Siemens' improvements in the construction of electro-magnets will prove advantageous,—more especially if care be taken to associate two magnets of equal power.

ON NEW COMPOUNDS OF AMMONIA WITH FERRO-CYANIDES, AND PARTICULARLY FERRO-CYANIDE OF NICKEL.

BY M. A. REYNOSO.

On pouring an excess of ammonia upon recently precipitated and moist ferro-cyanide of nickel, it will first dissolve, then change color, and almost immediately produce a precipitate, composed of a multitude of very fine crystals, of a violet tint. Great difficulty was found in bringing this compound to a dry state, fit to analyze, in consequence of its extreme instability; for, on exposure to the air, it became decomposed into ferro-cyanide of nickel and ammonia, which was volatilized; and the application of other dry gases also failed to effect the purpose,—a current of dry ammonia having been passed through a tube containing this salt for the space of three days without effect. This object was eventually attained by M. A. Reynoso in the following manner:—He prepared a rather considerable quantity of the salt, and, after washing it well with water containing ammonia, left it exposed to the air on a filter for two days;—that part which was in contact with the air became completely decomposed; but, in the centre of the filter, a portion of undecomposed salt was found, in the form of violet-blue crystals, lying very close together. This compound, thus treated, acquires more stability; it no longer decomposes on being exposed to the air; but, when submitted to a temperature of from 100 to 150°, it decomposes, giving up water and ammonia. The residue is not, however, ferro-

cyanide of nickel, as, on raising the temperature, ammonia and hydrocyanate of ammonia are disengaged, leaving pyrophoric carburets of nickel and iron, which take fire with a crackling noise, and burn in the air like a fusee.

If, instead of submitting the dry salt to the action of heat, the damp salt be boiled in water, it becomes decomposed into ferro-cyanide of nickel, water, and ammonia. The ferro-cyanide of nickel, thus obtained, is perfectly pure; and this means of preparing it is the only one by which it can be obtained free from cyanide of potassium; it appears, in fact, impossible to separate it from ferro-cyanide of potassium. When it is prepared by precipitating a salt of nickel by ferro-cyanide of potassium (even after having been washed for several days with hot water), it leaves an alkaline ash. It is not necessary to boil it, as the ammoniacal ferro-cyanide of nickel is decomposed at the ordinary temperature,—the process being, however, much slower. The weak acids attack the ammonia without touching the disengaged ferro-cyanide of nickel; but concentrated acids decompose ferro-cyanide of nickel in the ordinary manner. Potash disengages ammonia, and produces a precipitate of oxide of nickel and ferro-cyanide of potassium.

The ammoniacal ferro-cyanide of nickel is prepared, as above stated, in the most direct manner, by pouring ammonia upon recently precipitated and damp ferro-cyanide of nickel;—it may also be prepared by pouring ferro-cyanide of potassium in a solution of nickel containing a large quantity of ammonia; or by causing the salt of nickel in solution to react upon a mixture of ammonia and ferro-cyanide of potassium. In all cases, the crystals of the salt will be finer in proportion to the slowness of their formation. On analysis the formula of this salt appeared to be—$2NiCy, FeCy, 5NH^3, 4HO$.

Bi-ammoniacal ferro-cyanide of nickel: $2NiCy, FeCy, 2NH^3, HO$. On pouring ferro-cyanide of potassium into a solution of ammoniacal nitrate of nickel, a greenish-white precipitate is obtained, which, after being well dried, exhibits a mass of a dark green color, and becomes white on being pulverized. It adheres to the tongue, and is perfectly insipid; and is insoluble and unchangeable in water. Weak acids act upon it in the same manner as upon the preceding salt; it is, however, less easily destroyed. Ammonia dissolves it, and changes it to quinto-ammoniacal ferro-cyanide. It is decomposed by heat,—ammonia, and hydro-cyanate of ammonia being evolved, leaving a carburet, which fuses in burning. This salt combines, or rather mixes, with ammoniacal ferro-cyanide of copper, producing a fine peach-coloured precipitate; the best means of obtaining this precipitate, is to precipitate, by ferro-cyanide of potassium, a mixture of ammoniacal nitrate of nickel and ammoniacal nitrate of copper.

Bi-ammoniacal ferrid-cyanide of nickel.—On pouring ferrid-cyanide of potassium into ammoniacal nitrate of nickel, a fine

yellow precipitate is obtained, soluble in an excess of ammonia,—the formula of which is $3NiCy, Fe^2Cy^3, 2NH^3, HO$.

All the ferro-cyanides and ferrid-cyanides of metals, the oxides of which are soluble in ammonia, are themselves soluble in ammonia (the alkaline solution of ferrid-cyanide of cobalt is of a very deep red color). The protoxides of manganese and iron are, however, exceptions, as they are insoluble in ammonia.

The ferro-cyanides and ferrid-cyanides of those metals, the oxides of which are soluble in potash, are themselves soluble in potash. Thus potash poured upon ferro-cyanide of zinc, produces, at first, ferro-cyanide of potassium and oxide of zinc, which is dissolved in excess of potash. If the potash be added with care, on filtering, the liquor will contain only ferro-cyanide of potassium, and oxide of zinc will remain on the filter. With ferro-cyanide of mercury the reaction is very complete;—this compound is white, and on treating it with potash, ferro-cyanide of potassium and yellow oxide of mercury (insoluble in an excess of potash) will be produced.

ON THE COLORING MATTER OF THE ORANGE-LEAVED MORINDA (MORINDA CITRIFOLIA.)

BY MR. T. ANDERSON.

THE substance which forms the subject of this paper was introduced some time ago into Glasgow under the name of *Sooranjee*, as a substitute for madder in the operation of dyeing. Experiments were, immediately after its importation, made with it by some of the first cotton printers in Glasgow, and the uniform opinion formed was, that this substance was not a coloring matter, and, therefore, could not be of any utility. Professor Balfour having forwarded some samples of the root to Mr. Anderson, that gentleman subjected them to chemical analysis. The seeds of this plant seemed perfectly identical with those of the sooranjee or soorinjee,—a quantity of which Mr. Anderson had formerly received from Bombay. This plant appears to have been long known and employed by the natives for the production of coloring matter. Unfortunately Mr. Anderson did not succeed in causing these seeds to germinate, which prevented the possibility of his studying the native plant itself, and comparing its characteristics with those of the pretended mother plant.

The morinda citrifolia has been described by Rheede (*Hortus Malabaricus* I., 97) under the name of *cada pilava*, and is known to botanists under the name of *Bancutus latifolia Rumphi* (*Herbar Amboinense* V., cap. 13). In these works, it is expressly stated that the roots of the species mentioned do not possess any dyeing properties; whilst those of the *Bancutus angustifolia*, or morinda citrifolia, of modern botanists (doubtless the *wongkudu* of the Japanese dyers) is employed for the production of a splendid

scarlet color. An exact description of the cultivation of the morinda citrifolia, and its employment for dyeing, is given by Hunter (Asiatic Researches IV., 35). He also calls attention to the fact, that this plant is known in Malacca under the name of *aal*, and in Oude under that of *atchy*. It does not appear that any chemical analyses have yet been made of this root. Dr. Bancroft has, however, made some observations upon a root introduced from India under the name of *aurtch*, which resembles madder in appearance, and seems to belong to the morinda citrifolia. As to the name sooranjee, which it has received, no definite information could be arrived at as to its derivation. Sooranjee is the root of the plant; and, as imported, it consists of pieces from one to two inches in thickness, and varying in diameter from three to twelve-thirtieths of an inch. In the largest pieces, the bark is thick, and constitutes the greatest part of the root; but, in pieces of a smaller size, the bark is much thinner,—its outside color is of a pale yellowish-brown; but, when broken, it presents, in the interior, a color varying from a fine yellow to a reddish-brown. The wood itself is of a light yellow color, becoming deeper towards the centre, and scarcely perceptible near the bark. Alkalies cause it to assume a deep red color, which indicates the presence of a certain quantity of coloring matter. The bark or rind is easily removed, and presents, on its inner face, a peculiar silvery lustre, which is very evident in large pieces, but is scarcely discernible in the small pieces. On boiling in water, the inside furnishes a yellow color; and, if boiled with alcohol, a deep red is produced.

In order to prepare the coloring matter from sooranjee, which Mr. Anderson calls morindin, the treatment with boiling water was first adopted,—preliminary experiments having shewn that this substance was easily soluble in that liquid: it was soon ascertained, however, that this method was not applicable, as the decoction contained a viscous matter, which presented an obstacle to filtration. The employment of alkalies, in which this substance is rapidly dissolved, appeared also to be impracticable; Mr. Anderson was therefore obliged to have recourse to alcohol, which perfectly answered the purpose. The bark or rind, after being deprived of all its ligneous parts, and ground to a fine powder, was boiled with six times its weight of rectified alcohol. The solution, after having been filtered while hot, was of a deep brownish-red color; and, on cooling, deposited a brown flaky precipitate, containing the morindin, and other coloring matters found in the root, although in small proportion. A second decoction, with the same quantity of alcohol, furnished a paler solution, in which the morindin was deposited with a much less quantity of red coloring matter. The same treatment was repeated until, on the dyeing matter cooling, no further deposit was obtained. Each of these latter decoctions furnished a substance purer and purer,—so that, at last, it was deposited in the

form of small yellow crystals. By means of repeated crystallization in alcohol at 50°, the red substance was completely removed and a fine yellow color obtained; but still some impurity remained,—for, in one instance, a residuum of 0·47 per cent. of ash was left; and, in another, a residuum of 0·32 per cent. The elimination of these mineral matters could not be effected by crystallization in alcohol, but only in alcoholic solutions, sharpened with hydrochloric acid. In this liquor the morindin is crystallized in a perfectly pure state.

Morindin is separated from its solution in the form of small crystals, grouped in the same manner as those of the wavelite. These crystals are exceedingly delicate, and, when collected and dried on a filter, present the appearance of a sulphur-colored mass, having a silky lustre. These crystals are not very soluble in cold alcohol; but are dissolved, in large proportion, in boiling alcohol, especially when it is diluted. The solution, on cooling, is converted into a mass of crystals, which shrink very much on being dried, are but slightly soluble in alcohol, and almost insoluble in ether.

Morindin is dissolved, in very small proportion, by means of cold water; but sufficient to impart a yellow color to it. At the boiling point, it is dissolved in much greater abundance; and, on cooling, is precipitated from its solution in the form of a gelatinous mass, which presents no traces of crystallization. It obstructs the passages of the filter, and, consequently, cannot be separated from its mother liquor. Morindin is dissolved by alkalies, to which it imparts a fine orange-red color. By concentrated sulphuric acid, it is changed to a deep purple-red, which, in thin layers, appears of a violet color. After remaining in a state of repose for twenty-four hours, the solution, on being diluted, deposits yellow flakes of coloring matter, completely insoluble in cold water, and furnishing, with ammonia, a violet and not an orange-colored solution. Nitric acid, of sp. gr. 1·28, in the cold state, slowly dissolves morindin, and is thereby converted into a deep brownish-red color. In the hot state, the action is brisk, the brown color disappears, and nitrous vapours are disengaged in abundance. The liquor, on being submitted to continued ebullition, and neutralized by means of ammonia, furnished no precipitate with salts of lime.

Morindin in solution gives, with basic acetate of lead, a crimson-red precipitate, flaky, and extremely fugitive, and which cannot be washed without loss of coloring matter. Solutions of baryta, strontian, and lime, furnish an abundant red precipitate, slightly soluble in water. Chloride of iron produces a deep brown color, but does not give any precipitate. On adding alum to an ammoniacal solution of morindin, this latter is precipitated, together with the alumina, in the form of reddish-colored lac; and by the addition of chloride of iron, the precipitate becomes brown, and is not distinguishable from that of pure oxide of iron; it

however contains the whole of the morindin,—the supernatant liquor being colorless. On heating the morindin in a close vessel, it melts into a deep brown liquid, which boils at a high temperature, and afterwards disengages vapors of a splendid orange-color, analogous to the nitrous vapors, and which are deposited upon cold bodies in the form of oblong red crystals;—a large quantity of carbonaceous residuum remaining in the vessel. An elementary analysis of morindin gave results which agree with the formula $C^{28}H^{15}O^{15}$. From this formula it would appear, that a remarkable analogy exists between morindin and the coloring matter of madder. This circumstance is so much the more worthy of notice, that it indicates identity in the chemical nature of plants, which approach very nearly to each other in natural classification. Morinda, in fact, belongs to the natural family of chicoraceœ, which is considered by many botanists to be a subdivision of the rubiaceœ, of which madder (*rubia tinctorum*) is the type. This analogy does not extend further than the coloring properties,—the two substances differing essentially from each other.

It has been stated above, that the experiments of several printers at Glasgow, to produce upon cotton fabrics a coloring matter from sooranjee, completely failed. This is quite confirmed as respects the ordinary methods of mordanting. Mr. Anderson digested some morindin for a considerable time, and at a gradually increasing temperature, with pieces of stuff which had been mordanted with alumina and iron; the coloring matter was not, however, fixed, and the mordants, after boiling for a few minutes with soap, did not undergo any alteration. With the root itself, the fabric, mordanted with alum, acquired a greyish-red color, and with iron a rather deeper color; there was, however, considerable difference on trying a fabric mordanted for dyeing Turkey-red.

Mr. Anderson procured from Glasgow specimens of cotton fabric, prepared for Turkey-red according to the old and also the new method, and found, that after the lapse of a few hours, both of them had acquired a deep red-brown color, which did not possess any beauty, but was perfectly fast. These observations agree with the remarks made by Hunter on the method employed by the Hindoos in dyeing with the morinda plant. According to his account, the fabric is first immersed in an imperfect soap, obtained by mixing oil of sesame with soda lye, and, after being washed and scoured, it is treated with a decoction of myrobolans (astringent fruits of the *Terminalia chebula*) and finally exposed, for four or five days, to the sun. After undergoing this treatment, it is immersed in an alum bath; it is then wrung dry and again exposed for four or five days.

By another method the morinda roots are pulverized, damped with sesame oil, and mixed with the flowers of the *Lythrum fruticosum*, or a corresponding quantity of *Purwas* (galls of a species

of mimosa). This mixture is, with the cotton, introduced into a large quantity of water, and kept at the boiling point over a moderate fire for about three hours: a red color is thus obtained, which, according to Hunter, possesses great durability and beauty. This process is the one usually employed for dyeing Turkey-red; but Hunter further states, that with fabrics mordanted with iron a fixed purple-red or a chocolate color may be obtained; and that in that case the color is probably produced by the tannic acid of the astringent substance employed in the process.

It has been stated above, that morindin is decomposed by heat, and a carbonaceous residuum left in the vessel,—a crystallizable matter, totally different in its properties from the original substance, being sublimed. Mr. Anderson gives to this substance the name of *morindon*. It has the form of long crystals, which, when inspected through a microscope, present the appearance of six-sided prisms, with an oblique base, and have a red color of extraordinary brightness. These crystals are insoluble in water (either hot or cold), but will readily dissolve in either alcohol or ether. The morindon may be easily obtained from these solutions, in the form of crystals, by careful evaporation. This substance is dissolved by alkalies, and thereby acquires a rich violet color. Concentrated sulphuric acid also dissolves it, and imparts to it the same rich violet color: on evaporating the solution a precipitate is formed. By adding alum to an ammoniacal solution, a red lac is produced; and with baryta-water a cobalt blue precipitate is formed. The small quantity of morindon obtained did not allow of its being brought to a perfect state of purity; Mr. Anderson, therefore, merely washed the sublimed crystals with ether, in order to deprive them of all empyreumatical matters, and dried them at the temperature of 100° Cent. On analysis they furnished a result agreeing with the formula $C_{28}H_{10}O_{10}$. Morindon, therefore, appears to be produced from morindin by the elimination of water; and this is confirmed by the change morindin undergoes when brought into contact with sulphuric acid. As was above stated, morindin is insoluble in water, and furnishes, with alkalies, a violet color: this is also the case with morindon. Now, as the sulphuric acid acts in the ordinary manner, viz., by extracting the water, it appears very likely that the morindin loses five equivalents of water, and is thereby converted into morindon.

Supposing that further experiments should confirm the formula given above for morindon, a strong analogy would be established between the coloring matter of this substance and that of madder,—the only difference between them being that of one equivalent of water. It appears, therefore, that morindon really is a coloring matter, and is capable of entering into combination with the ordinary mordants. With alumina it furnishes a deep lively red, and with iron a violet or black. These colors are, however, not fast, and moreover have the disadvantage of

combining with the non-mordanted portions of the fabric, and of adhering to the parts desired to be left white. The morindon, when treated with sulphuric acid, will enter into combination with the ordinary mordants.

The discovery of a peculiar coloring matter, which only combines with a fabric which has been treated with oil, in the manner practised for Turkey-red dyeing, is so much the more interesting that it shews the existence of a peculiar class of substances which had not hitherto been noticed. The theory of Turkey-red dyeing, which has been for many years a secret in chemistry, may, perhaps, by this means, have some light thrown upon it; for, although this method of dyeing was imported into Europe some centuries ago, and many improvements have been made upon it, yet, during this lengthened period, no satisfactory explanation of the process has yet been arrived at.

It may be presumed, that by the action of the dung, which is employed in large quantity, the fabric becomes, as it were, animalized; by means of which it acquires the property of being charged with finer and brighter colors than when simply mordanted with mineral substances. Further researches have moreover proved, that the oil, which is employed in large quantity in Turkey-red dyeing, when brought into contact with the air and with decomposed animal matter, becomes also decomposed, and is converted into a sort of resinous matter, which constitutes the mordant for Turkey-red dyeing. M. Weissgerber, to whom we are indebted for some experiments on this subject (an account of which is given by M. Persoz in his *Traité Théorique et Pratique de l'impression des Tissus*, Vol. III., p. 174), found that fabrics treated with oil took a fine lively red; that, by means of acetone, the oil might be extracted, and that it would be found to have undergone no change; also, that after each successive application of the acetone, the fabric gradually lost the property of taking up the coloring matter of the madder, until at last (the whole of the oil having been extracted) the fabric would come out of the dye-bath without taking up any color. The same chemist also found, that by employing the extract obtained by the acetone, as a mordant, a very fine color was produced with madder, without the necessity of adding any other substance. The observations of M. Weissgerber are confirmed by the experiments detailed in this memoir; there being no doubt that the deep red color obtained from morindin was produced in a manner totally independent of the alum, as this salt does not possess the property of fixing the coloring matter.

M. Persoz and Mr. Anderson both seem to be of opinion that the alum now used for Turkey-red dyeing will be completely abandoned, when Turkey-red dyers shall have become acquainted with the nature of the modification which the oil undergoes during the operation.

TRANSACTIONS OF THE SOCIETY OF ARTS.

May 1st, 1850.

A paper was read on the causes and preventives of mildew in paper and parchments; with an account of experiments made on the saturation of growing wood with antiseptic chemical solutions, by Alfred Gyde, Esq., M.R.C.S.E.*

The author stated that, owing to the imperfections formerly existing in the microscope, little was known of the real nature of the class of plants called *fungi* until within the last few years; but, since the improvements in that instrument, the subject of the development, growth, and offices of the fungi has received much attention. They compose, with the algæ and lichens, the class of thallogens (Lindley),—the algæ existing in water, the other two in air only. A fungus is a cellulur flowerless plant, fructifying solely by spores, by which it is propagated, and the methods of attachment of which are singularly various and beautiful. The fungi differ from the lichens and algæ in deriving their nourishment from the substances on which they grow, instead of from the media in which they live. They contain a larger quantity of nitrogen in their constitution than vegetables in general do, and the substance called "fungine" has a near resemblance to animal matter. Their spores are inconceivably numerous and minute, and are diffused very widely, developing themselves wherever they find organic matter in a fit state. The principal conditions required for their growth are moisture, heat, and the presence of oxygen and of electricity. No decomposition or development of fungi takes place in dry organic matter: a fact illustrated by the high state of preservation in which timber has been found after the lapse of centuries, as well as by the condition of mummy-cases, bandages, &c., kept dry in the hot climate of Egypt. Decay will not take place in a temperature below that of the freezing point of water, nor without oxygen; by excluding which—as contained in the air—meat and vegetables may be kept fresh and sweet for many years.

The action which takes place when moist vegetable substances are exposed to oxygen, is that of slow combustion (it has been called by Liebig "eremacausis"),—the oxygen uniting with the wood and liberating a volume equal to itself of carbonic acid, and another portion combining with the hydrogen of the wood to form water. Decomposition takes place on contact with a body already undergoing the same change, in the same manner that yeast causes fermentation. Animal matter enters into combination with oxygen in precisely the same way with vegetable matter; but as, in addition to carbon and hydrogen, it contains nitrogen, the products of the eremacausis are more numerous—carbon and nitrate of ammonia, carburetted and sulphuretted hydrogen, and

* This paper was rewarded, in 1848, with the Society's gold Isis medal.

water; and these ammoniacal salts greatly favor the growth of fungi. Now paper consists essentially of woody fibre, having animal matter, as size, on its surface.

The first microscopic symptom of decay in paper is irregularity of surface, with slight change of color, indicating the commencement of the processes just noticed; during which, in addition to carbonic acid, certain organic acids are formed—as crenic and ulmic acids,—which, if the paper has been stained by a coloring matter, will form spots of red on the surface. Spots of the same kind are similarly formed on leather, colored during its manufacture. Provided that fungi have not taken root, the color can be restored by ammonia or any alkali. The same process of decay goes on in parchment as in paper—only with more rapidity, from the presence of nitrogen in its composition. When this decay has begun to take place, fungi are produced—the most common species being *penicillum glaucum*: they insinuate themselves between the fibre, causing a freer admission of air, and consequently hasten the decay.

The substances most successfully used as preventives of decay are, the salts of mercury, copper, and zinc. Bichloride of mercury (corrosive sublimate) is the material employed in the kyanization of timber, the probable mode of action being, its combination with the albumen of the wood, to form an insoluble compound, insusceptible of spontaneous decomposition, and therefore incapable of exciting fermentation. The antiseptic power of corrosive sublimate may be easily tested by mixing a little of it with flour paste; the decay of, and appearance of fungi on which, are quite prevented by it. Next to corrosive sublimate, in antiseptic value, stand the salts of copper and zinc. Chloride of zinc has been patented by Sir W. Burnett for the preservation of wood, sail-cloth, &c., and appears to succeed admirably. For use in the preservation of paper, the sulphate of zinc is better than the chloride, which is, to a certain extent, deliquescent.

A series of experiments were made by the author, in the summer of 1840, on the use of metallic and other solutions for the preservation of wood. A deep saw-cut was made all round the circumference of some growing trees, near their base, into which the solutions were introduced by forming a bason of clay beneath the cut: thus the solution took the place of the ascending sap, and, in periods of time varying from one to three days, was found to have impregnated even the topmost leaves of trees fifty feet high. The trees were chiefly beech and larch. After impregnation they were felled, and specimens, about five feet long by two inches square were cut out, and packed in decaying saw-dust in a warm damp cellar, where they were left for seven years. The details of the experiment are given in a table, by which the following general results are made to appear:—The pieces of wood saturated with sulphate of copper, in the proportion of one pound to one gallon of water, or with acetate of copper, in the proportion

of one pound to one pint of vinegar and one gallon of water, were found in perfect preservation, clean, dry, and free from fungus; but the remaining pieces, which were saturated with nitrate of soda, prussiate of potash, pyrolignite of iron, sulphate of iron, common salt, and creosote, presented much decay, and a large growth of fungi.

The results obtained from solutions of corrosive sublimate—one-eighteenth of a pound to a gallon of water (Kyan's proportion)—varied in an anomalous manner.

The paper was accompanied by specimens of the wood, shewing how complete had been the saturation.

At the conclusion of the above paper, a communication was read—

On the patent safety steering-wheel of CAPTAIN FAYRER, R.N., *and* LIEUT. ROBINSON, R.N.

Serious accidents occur to the helmsmen, in large vessels, from the little power which they have to resist the sudden shocks caused by the sea striking the rudder, by which the helm is often taken out of their hands, and they are either thrown overboard or much hurt. A constant experience of such accidents, during his command of the three large steamers, *President*, *Liverpool*, and *Forth*, and of the *Lady Flora*, Indiaman, led Captain Fayrer to consider some method of preventing them, and, at last, to this invention.

It consists in the application to the steering-wheel of a friction-band, similar to that used in cranes, which passes round a projecting circular rim inside the wheel, and is brought down to a pedal on the deck, by pressure on which any amount of friction can be put on the wheel. It is not desirable that the helm should ever be at a 'dead lock,' without the power of yielding a little to the shock of a very heavy sea, as that would endanger the carrying away of the rudder; an adjusting screw is therefore provided, by which the amount of *ultimate* friction that can be put on the wheel is regulated, and not left in the power of the steersman.

A great advantage of this invention is the power which it gives of fixing the rudders of vessels lying in a tide-way or harbour, and thereby preventing the continual wear on the pintles of the rudder, and, in time, the loosening of the stern-framing of the vessel.

Letters testifying to the merit of the safety steering-wheel, from eminent ship-builders and naval engineers, were read. It is being applied to the large steamers *Asia* and *Africa*, now building at Greenock for the North American mail service.

On the table was a sectional model of a vessel of large class, executed by Mr. Gee, a working shoemaker, to which the attention of the meeting was drawn, not only on account of the neatness of the workmanship, but as being in accordance with the

suggestion of his Royal Highness the President, in 1849, in encouragement of a "home occupation, such as prevails in Switzerland and Germany, secondary to other pursuits."

May 8th, 1850.

Mr. J. T. Towson, *of Devonport, read a paper to the Society—on the principles of great circle sailing.*

The method of navigation called great circle sailing has of late attracted much attention, owing to the very successful voyage accomplished by Captain Godfrey in the *Constance*, in which, by pursuing a course shaped on that principle, he succeeded in reaching Adelaide in 77 days after leaving Plymouth;—the average length of the passage being 110 days.

But though it has been only lately brought before the public, the method is far from being a new one. In 1495, Sebastian Cabot projected a voyage across the Atlantic on this principle, with a view of discovering a north-west passage to India; in 1537, in the first book published on the subject of navigation, it was treated of by Numez; while in 1561, Cortez, and, following him, Coignet and Zamarano, advocated the adoption of great circle sailing, in opposition to that by rhumb lines,* shewing that, since rhumb lines make endless revolutions round the globe, a course in which they are followed cannot be a direct one.

Mercator's and parallel sailing conduct the ship by a circuitous route, when compared with the track of a great circle; but the simplicity of the calculations connected with these sailings, and the circumstance that, by compass, the ship makes but one course throughout the voyage, led to their being preferred to great circle sailing, in which the course is continually changing.

To determine by calculation how much the course must be changed from time to time, has been a problem so tedious as to preclude its general adoption. Mr. Towson is the author of tables, published under the sanction of the Admiralty, by which this practical difficulty is overcome, and this method rendered as easy of adoption as any other,—the calculations being reduced to a mere inspection. To him, therefore, belongs the honor of having reduced to practice, and brought within the reach of all navigators, that which was before the property only of a few.

The fundamental principle of this method is that axiom of spherical geometry, that the shortest distance between any two points on the surface of a sphere lies on the line of a "great circle;" or, in other words, of a circle having the same diameter as the sphere; as it will be found, if a number of arcs be drawn, each having the same chord, that the arc which is a portion of the largest circle will describe the shortest route between the two extremities of the chord. Maps and charts being *flat* re-

*"Rhumb lines," in nautical language, are the parallels running round the globe at right angles to the meridian lines; and which, on Mercator's charts, appear as horizontal straight lines.

presentations of the surface of a *globe*, are of necessity distorted, and are only tolerably correct near the Equator,—the distortion increasing as the poles are approached; and hence it follows that the course which on the globe is the shortest, is on the chart made to appear very much the longest; and *vice versâ*. This was clearly shewn to be the case by the comparison, on a chart and on a globe, of the course between Van Dieman's Land and Valdivia on the western coast of South America: the course which by the chart appeared to be a straight line, when laid down upon the globe, was found to be very circuitous; whilst the line of a great circle, cutting the two points, appeared on the chart as a loop of great length.

A chart was exhibited shewing a striking instance of the practical advantage possessed by the great-circle course over the ordinary one, as well as of the errors which occur from non-adoption of the method. Some years since, the American government desired their officers to report on the best route for steam communication between Monterey and Shanghae; and a course as nearly as possible direct, according to the chart, was laid down for the vessels, by which they were to go slightly northwards, touching at the Sandwich Islands for coal. While this was under consideration, Lieutenant Maury, of the United States Navy, became acquainted with Mr. Towson's method,—upon which, in June 1847, he reported to his government; and he proved not only that the course which by the chart appeared so straight was not the most direct, but that by following a great-circle route (bearing northwards and touching at the Fox or Alieutian Islands), the whole distance would be little more than half that by the former; a saving being effected of fully 3000 miles.

It does not, however, always happen that a great-circle course can be rigidly followed. Numberless circumstances, affecting especially sailing-vessels, such as bad winds and currents, and the necessities of traffic, occur to make the shortest course in *geometry* not always the shortest in *time*; and hence arises the necessity of the method of composite great-circle sailing, in which the course lies as far as possible on the lines of two great circles, which are successively followed. This may be briefly explained as follows:—Supposing that it be desired to sail from one place A, to another C, but that the existence of some obstacle, such as land, intervening, or the prevalence of contrary winds, would prevent the vessel from following the track of one great circle only between the two points,—then the navigator must follow the track of one great circle from A, to the intermediate point B; and from B, he must sail in the track of another great circle to C. In practice, this method, the discovery of which is due to Mr. Towson alone, is often the only one available to sailing-vessels, which cannot, as steamers can, pursue a rigid, unwavering course. The composite course from Valparaiso to Van Dieman's Land was shewn to be 770 miles shorter

than that which on the chart appeared as a straight line. Captain Godfrey's voyages were the first made by the composite route.

MAY 15TH, 1850.

A paper was read on "Siemens' regenerative condenser," by Mr. C. W. SIEMENS, *of Birmingham.*

The paper commences with an historical sketch of the condenser of the steam-engine, from the invention of Savery (in which a single vessel served the triple purpose of steam-cylinder, condenser, and water pump) to James Watt's injection condenser. Hornblower proposed a surface condenser, which was, however, deficient in extent of cooling surface, and therefore failed, as have many others invented since;—the most prominent being that of Mr. Samuel Hall, in which the steam was passed through tubes immersed in a stream of cold water. This condenser has the serious drawbacks of weight, costliness, and difficulty of getting rid of the calcareous deposits from the condensed steam.

Three years ago Mr. Siemens invented his surface condenser for a situation where economy of space and material was essential. It consists of a number of copper plates of $\frac{3}{32}$ inch in thickness, $4\frac{1}{2}$ inches broad, and 2 feet long, which are piled together with two longitudinal flattened wires of the same metal intervening between the adjacent plates; and the whole pile is screwed up tight together between the sides of a rectangular cast-iron vessel, constituting the body of the condenser. The ends of the plates project through the top and bottom of the vessel, and are planed flush with its exterior surfaces. The joints are secured at top and bottom by means of India-rubber rings, screwed down under small cast-iron frames: which rings yield to the difference in expansion of the two metals. The flattened wires are laid parallel, and about three inches apart, and form, with the plates, a large number of narrow passages, through which the cold condensing water flows in an upward direction, without entering the vacuous space of the condenser, into which the ends of the plates outside the flattened wires—forming the condensing surfaces—project. The heat of the steam is thus passed through the plates, from their edges towards the centre, to the condensing water,—the limit to its efficiency being the conducting power of the metal. Its dimensions are as follows:—

Heat-absorbing surface by the water -	18 sq. ft. per H.P.
Condensing surface - - - - -	9 do. do.
Thickness of metal through which the heat is conducted - - - -	$1\frac{1}{4}$ inch
Weight of copper - - - -	60 lbs. per H.P.
Space occupied by plates - - -	·4 cube ft. do. do. = $\frac{1}{10}$ part of the space occupied by the tubes in Hall's condenser.

Its essential features are, its comparative cheapness of construction, the easy access it affords to the water-channels, and the reduction in the quantity of condensing water required.

The Regenerative Condenser.—The origin of this condenser was the suggestion, to the author, of Mr. Graham, of Mayfield Works, "to recover the heat from the condensing-water in the form of a reduced amount of boiling hot water." It consists of an upright rectangular trunk of cast-iron, the lower end of which is cylindrical, and contains a working piston, which performs two strokes for each one of the engine. In the trunk is a set of copper plates, upright and parallel to each other,—the intervening spaces being the same as the thickness of the plates, viz. between 1-12th and 1-16th of an inch. The upper extremity of the condenser communicates on one side with the exhaust-port of the engine, and on the other, through a valve, with the hot-well. The plates are fastened together by five or more thin bolts, with small distance-washers between each plate. There is a lid at the top of the trunk, by removing which the set of plates can be lifted out. Immediately below the plates the injection-pipe enters.

The action of the condenser is as follows:—Motion is given to the piston. At the moment that the exhaust-port of the engine opens, the plates are completely immersed in water, a little of which has entered the passage above the plates, and is, together with the air present, carried off by the rush of steam into the hot well,—the excess of steam escaping into the atmosphere. The water then, in consequence of the downward motion of the piston, recedes between the plates, exposing them gradually to the steam, which condenses on them. Their upper edges emerging first from the receding water, are surrounded by steam of atmospheric pressure, and become rapidly heated to about 210°. The immersion of the plates still continuing, the steam is constantly brought into contact with fresh cool surface, by which the greater portion of it is condensed, until, as the piston descends, the injection enters and completes the vacuum. This is done by the time the working piston of the engine has accomplished 1-7th of its stroke. The upper extremities of the plates become heated to near 210°, and the lower to about 160°.

Taking the initial temperature of the condensing water at 60°, the final temperature at 210°, and the latent heat of steam at 212°, 960 units, the quantity of water required is 6·6 lbs. to condense 1 lb. of steam of atmospheric pressure. The common injection condenser (supposing the temperature of the condensed steam to be 110°) requires 21·2 lbs. in place of 6·6 lbs.

The advantages of this condenser are:

1. Additional effective power gained on account of the vacuum = 30 per cent., taking the pressure of steam at 40 lbs. above the atmosphere, and the vacuum in the cylinder at 12 lbs.

2. Heat saved in generating steam by the use of boiling feed-water = 10 per cent. over the ordinary method of heating the feed-water to 110°, or 15 per cent., when no use is made of the condensed water for that purpose.

3. The steam which escapes uncondensed may be used to cause draft.

4. The displacing cylinder takes no motive power.

5. The condenser may be started and stopped at any time by turning the injection water on or off. If turned on, it at once forms the vacuum without involving the necessity of blowing through; and if turned off, it allows the engine to proceed as though it had not a condenser.

6. The air contained in the condenser is at each stroke completely expelled.

7. Greater compactness, and less expense, than the injection condenser.

Its dimensions in terms of parts of the engine are as follows:—Area of plate-chamber = three times that of exhaust-pipe; length of plates = one third that of stroke of engine; thickness of plates, $\frac{1}{252}$ of their length; spaces between plates same as thickness, but never more than 1-16th of an inch, as with that dimension no sediment can stand against the rush of water. Capacity of displacing cylinder = that of plate-chamber.

It has been attempted to adapt this condenser to the locomotive; and of the advantages which would be gained if this could be done, there can be no doubt. In this case, the two condensers were cast in one piece, and placed directly in front of the cylinders. They differed from that just described only in the length of the condenser and stroke of the displacing piston being much shortened (so that the velocity of the water between the plates should not be too great); and in having a second set of discharge-valves of peculiar construction for allowing the uncondensed steam to pass freely into the funnel. The ordinary supply of feed-water not being by itself sufficient to maintain the vacuum, this condenser, if applied to locomotives, should only be worked at intervals, on inclines, &c., where its assistance would be needed.

In its application to low-pressure engines, since the steam from the cylinder has not sufficient power to force the air and heated water from the condenser into the atmosphere, a communication is made between the exhaust-valve of the condenser and the lower end of the displacing-cylinder, which, for convenience of arrangement, is here reversed, and receives the charge of water and air when its piston is at the opposite end of it, and when it is therefore vacuous. In this case the amount of injection-water is reduced in the proportion of three to one. Ten per cent. is saved by the feed-water being made boiling hot,—a great quantity of boiling water being provided which cannot fail to be useful for many purposes.

The first regenerative condenser was applied to a sixteen horse-power high-pressure engine, at Saltby Works, near Birmingham, in September 1849, where it has been found to answer. One is now being erected at the Paper Works of Messrs. Easton and Amos, at Wandsworth, and will shortly be in action.

A drawing was exhibited, shewing the condenser applied to a common high-pressure engine, in connexion with a variable expansion valve, acted on by a governor, which is a modification of Mr. Siemens' chronometric governor,—the pendulum being superseded by an expanding fly-wheel.

The principle involved in the regenerative condenser is applicable to many useful purposes, the most remarkable of which are, what Mr. Siemens proposes to call his regenerative evaporator for brine and other liquids, and his regenerative engine (which are now in course of construction at the works of Messrs. Fox and Henderson, near Birmingham, to whose enterprise Mr. Siemens expresses himself as indebted for the carrying out of his several inventions).

After the reading of the paper, a discussion took place, chiefly as to the practicability of applying the condenser to locomotives, in which Mr. Scott Russell, Mr. Crampton, and the author took part. It was closed by the chairman, who said that the circumstances of the locomotive were so peculiar—the requirements of the most perfect simplicity, and of freedom from any but the most necessary dead weight so absolute—that he feared this could not be applied to it, even if (which he doubted) the condensation could take place rapidly enough where the cylinder was filled and emptied four times in one second. But the principle was new to him, and certainly highly ingenious, as were the other inventions of Mr. Siemens; and in its application to stationary engines, he hoped and believed his ingenuity would meet its due reward.

May 22nd, 1850.

A communication was made to the Society on the application of electro-magnetism as a motive power, by Mr. Robert Hunt.

The author called attention, in the first place, to the numerous attempts which have been made to apply electro-magnetism as a power for moving machines, and referred to the apparatus employed by Jacobi, Dal Negro, M'Gauley, Wheatstone, Hjorth, and others. Since, notwithstanding the talent which has been devoted to this interesting subject, and the large amount of money which has been spent in the construction of machines, the public are not in possession of any electro-magnetic machine which is capable of exerting any power economically; and finding that, notwithstanding the aid given to Jacobi by the Russian government, that able experimentalist has abandoned his experi-

mental trials,—the author has been induced to devote much attention to the examination of the first principles by which the power is regulated, with the hope of being enabled to set the entire question on a satisfactory basis.

The phenomenon of electro-magnetic induction was explained, and illustrations given of the magnetisation of soft iron by means of a voltaic current passing around it. The power of electro-magnets was given, and the author stated his belief that this power could be increased almost without limitation. A voltaic current produced by the chemical disturbance of the elements of any battery, no matter what its form may be, is capable of producing by induction a magnetic force,—*this magnetic force being always in an exact ratio to the amount of matter (zinc, iron, or otherwise) consumed in the battery.*

Several forms of the voltaic battery were explained, particularly those of Daniell, Grove, Bunsen, and Reinsch,—the latter being constructed without metals, depending entirely on the action between two dissimilar fluids, slowly combining.

The author had proved, by an extensive series of experiments, that the greatest amount of magnetic power is produced when the chemical action is the most rapid. Hence, in all magnetic machines, it is more economical to employ a battery under an intense action, than one in which the chemical action is slow. It has been proved by Mr. Joule, and most satisfactorily confirmed by the author, that one-horse power is obtainable in an electro-magnetic engine the most favorably constructed to prevent loss of power, by the consumption of 45 pounds of zinc, in a Grove's battery, in 24 hours; while 75 pounds are consumed in the same time to produce the same power in a battery of Daniell's construction. The cause of this was referred to the necessity of producing a high degree of excitement, to overcome the resistance which the molecular forces offer to the electrical perturbations, on which the magnetic force depends.

It was contended, that although we have not perhaps arrived at the best form of voltaic battery, yet that we have learned sufficient of the law of electro-magnetic forces to declare, that, under any conditions, the amount of magnetic power would depend on the change of state—consumption of an element—in the battery,—and that the question resolved itself into this:—What amount of magnetic power can be obtained from an equivalent of any material consumed? The following were regarded as the most satisfactory results yet obtained:—1. The force of voltaic current being equal to 678, the number of grains of zinc destroyed per hour was 151, which raised 9000 pounds one foot high in that time. 2. The force of current being, relatively, 1300, the zinc destroyed in an hour was 291 grains, which raised 10,030 pounds through the space of one foot. 3. The force being 1000, the zinc consumed was 223 grains; the weight lifted one foot 12,672 pounds.

The estimations made by Messrs. Scoresby and Joule, and the results obtained by Œrsted, and more recently by Mr. Hunt, very nearly agree; and it was stated that one grain of coal consumed in the furnace of a Cornish engine lifted 143 pounds one foot high,—whereas one grain of zinc consumed in the battery lifted only 80 pounds. The cost of one hundred weight of coal is under 9 pence; the cost of one hundred weight of zinc is above 216 pence. Therefore, under the most perfect conditions, magnetic power must be nearly 25 times more expensive than steam power. But the author proceeded to shew that it was almost proved to be an impossibility ever to reach even this condition, owing, in the first place, to the rate with which the force diminishes through space. As the mean of a great many experiments on a large variety of magnets, of different forms and modes of construction, the following results were given:—

The magnet and armature being in contact,—the lifting force was .... 220 pounds.

,,	distant $\frac{1}{250}$ of an inch	90·6	,,
,,	$\frac{1}{125}$	50·7	,,
,,	$\frac{1}{63}$	50·1	,,
,,	$\frac{1}{50}$	40·5	,,

Thus at one-fiftieth of an inch distance four-fifths of the power are lost. This great reduction of power takes place when the magnets are stationary. The author then proceeded to shew that the moment they were set in motion a great reduction of the original power immediately took place—that, indeed, any disturbance produced near the poles of a magnet diminished, during the continuance of the motion, its attractive force: the attractive force of a magnet being 150 pounds when free of disturbance, fell to one-half, by occasioning an armature to revolve near its poles. Therefore, when a system of magnets which had been constructed to produce a given power is set in revolution, every magnet at once suffers an immense loss of power, and consequently their combined action falls in practice very far short of their estimated power. This fact has not been before distinctly stated, although the author is informed that Jacobi observed it. And not merely does each magnet thus sustain an actual loss of power, but the power thus lost is converted into a new form of force, or rather becomes a current of electricity, acting in opposition to the primary current by which the magnetism is induced.

From an examination of all these results, Mr. Hunt is disposed to regard electro-magnetic power as impracticable, on account of its cost, which must necessarily be, he conceives, under the best conditions, 50 times more expensive than steam power.

The chairman agreed with Mr. Hunt in his conclusion of the improbability of any result being obtained from electro-magnetism which could enable it to compete with steam as a motive-power. At any rate, the point to which the attention of engineers and

experimentalists should be turned at present was, not the contriving of perfect machines for applying electro-magnetic power, but the discovery of the most effectual means of disengaging the power itself from the conditions in which it existed stored up in nature. Mr. Faraday assured us that in a single drop of water is contained as much electricity as is developed in a thunder-storm. The portion of this which we can liberate by any existing battery is very small—so small, that, as shewn by Mr. Hunt's paper, its practical use cannot be profitable. The study of electro-chemistry, he thought, was a more promising field, and one from which might at a future time be developed a power which should supersede even steam.

After Mr. Hunt's paper, the attention of the meeting was called to a model of a three-roomed labourer's cottage, which had been erected by Mr. W. N. Clay, at Harlow, in Essex, at a cost of 10*l*. only. The walls are formed of clay lumps dried in the sun, having an admixture of straw in their composition; the roof is of thatch; and the floor is made of concrete. Analogous modes of buildings, used not only for cottages, but for houses of large size, in Cornwall, Hampshire, and the West of England, were mentioned by several members, as well as the "Pisa-work" used in Italy for churches and large buildings.

A chair ingeniously composed of 492 small pieces of wood, dovetailing into each other, and holding together without either glue or pins, was shewn to the meeting. It is the work of a farm-labourer, named Selwood, of Charlton, near Pusey, in Wilts, and was entirely executed by him with a knife.

Mr. Varley, jun., explained his improvements in the air-pump. In place of the two barrels and vibrating intermittent motion of the ordinary pump, Mr. Varley has a continuous circular motion of the handle, and one double-acting barrel. The piston-rod is attached to a crank on the motion-shaft, and the cylinder oscillates from its bottom,—a packed joint being most ingeniously done away with by having the tube between the barrel and the receiver coiled spirally, which, by its spring, gives play enough for the oscillation of the barrel. Mr. Varley explained his larger pump, in which there are some ingenious contrivances in addition to those already mentioned. Instead of a valve opening inwards into the barrel by the pressure of the air, as in the old pumps, the valve is worked by an excentric, and is so arranged as to open a communication between the top and bottom of the barrel at each stroke, by which the rarefaction of the air is doubled. He has obtained, with this pump, a vacuum of one-tenth of an inch of mercury.

NOVEL ELECTRIC TELEGRAPH.

A correspondent of "The Farmer and Mechanic" (an American scientific periodical) gives the following account of an invention, recently patented by a Mr. Thomas, of Norwich, Chenago County, New York, and designated the "Electric Thermic Telegraph:"—It consists in applying heat, as a substitute for electricity or magnetism, in recording telegraphic communications; and, in its practical operation, is in no respect inferior to the system of either Morse or Bain; while, on some accounts, it is superior to both. It has been thoroughly tested, and the writer has reason to believe that, in the Patent Office, it was subjected, in all its parts, to a more rigid and critical examination than any invention for which a patent has ever been obtained; yet nothing was found to throw the slightest doubt upon its originality, or to conflict with it in the remotest degree. I cannot at present give a minute description of the invention; but it may be stated, that heat is used for making and recording the letters of the alphabet, and is generated by the electricity which passes over the wires of the telegraph. The electricity, after it reaches the recording instrument, is conducted on to an attenuated platinum point, in contact with the paper, which becomes instantly heated, or suddenly cold, according as the circuit of electricity is made or broken; and the application of the heat to the paper or other material produces the necessary mark. Common dry paper may be used for recording, but that which has been chemically prepared will probably be found to be the best. In this way, substantially the same result is produced as by Morse's or Bain's telegraph, but without the aid of a magnet, and without decomposing salt, which are peculiarities of the two systems alluded to, and upon which they are principally based. In all its details, in all its provision for signals, and in every thing connected with its practical operation, it has been carefully considered, and will be found to be as perfect as it is possible to desire.

THE EXECUTIVE COMMITTEE OF THE 1851 EXHIBITION.

It is a commonly-received proverb that comparisons are odious; and, doubtless, there is sufficient foundation for the assertion. May it not arise from the fact that comparisons are generally made by approximating extremes (which are themselves exaggerations) and thereby producing violent contrasts, mutually disadvantageous to the opposed interests; whereas, Truth erects her banner midway between extremes? Let us hope, for the credit of the Executive Committee for promoting the great Exhibition of 1851, that she will be able to reconcile the following conflicting statements respecting their fitness for the appointment which

they hold, or, at least, find a footing somewhere on neutral ground between the two literary antagonists. In reference to the Executive Committee—

The (American) *Farmer and Mechanic* says :—

It is composed of some of the most eminent engineers of the kingdom, viz., Henry Cole, Charles Wentworth Dilke, the younger, George Drew, Francis Fuller, and Robert Stephenson; for the purpose of carrying the instructions of the Commission into effect.

The *Mechanics' Magazine* says :—

Are they such as one might expect to see picked out, to be placed at the head of a grand public undertaking such as this professes to be? Men among the most eminent of their day in art, or science, or letters? Men not only well known and highly esteemed in their own country, but of European, at least, if not of world-wide reputation? Individuals whose names require but to be mentioned to inspire confidence, "not only in all classes of our subjects, but of the subjects of foreign countries?" *Risum teneatis amici?* Their names are Henry Cole, Charles Wentworth Dilke, junior, George Drew, and Francis Fuller, with one Mathew Digby Wyatt for Secretary;—five as obscure individuals as could well be got together in one group—not such even as you might impress from the streets, but such as could only be found out by poking into sundry holes and corners after them,—people distinguished for nothing whatever in the world,—people whom nobody knows—never heard of, either in their own country or out of it. Persons, too, who, if not the very same who falsely passed themselves off as the representatives of the Society of Arts, have been put forward to reap the benefits of the fraud practised on the Crown,—the nominees of impostors, if not impostors themselves! How is it possible that such "an Executive" can inspire either respect or confidence? Or how is it to be expected that any great party in the state would choose to identify themselves with such a pack of characterless nobodies?

The name of Mr. Robert Stephenson was notoriously added for the sake of garnish.

Premising that one of these statements is from a foreigner, who may, perhaps, have jumped at a rational conclusion, whereas the other is the deliberate assertion of a party whose position should have given him access to information, we must leave our readers to determine for themselves the probability of a satisfactory solution of the point in question.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Apr. 29. *Hardman, Norton & Co.*, of 6, Gresham-street, London, button-manufacturers and silk warehousemen, for an attacher for coats and other garments.

29. *Rowland Fothergill*, of Aberdare Iron Works, Glamorgan, for a sleeper for tram-plates.

29. *Joseph Peace*, of Sheffield, for a saw-handle.

30. *Joseph Chatwin*, of 97, Alcester-street, Birmingham, for "the Albert gas-burner."

30. *Hall & Wilson*, of Manchester, ironmongers, for a gas retort.

30. *Edward Thomas Loseby*, of 44, Gerrard-street, Islington, for a portable crane shower-bath.

30. *Shoolbred & Loveridge*, of Wolverhampton, for a hip-bath.

30. *Robert Barsby & William Wells*, of Dudley, for a day indicator.

30. *Samuel Daniel*, of Birmingham, for a looking-glass movement.

May 2. *Francis Pike Hewitt*, of Nottingham, for a compound elastic band or strap for articles of dress.

4. *Francis Drury*, of Albany-street, Regent's-park, for a steel bell.

6. *John O. Else*, of 308, Albany Road, Camberwell, for a beer and spirit preserver.

6. *John Holford & Edward Barry Collard*, of 12, Lord-street, Liverpool, for a frame for carpet and other bags.

9. *Dent, Allcroft, & Co.*, of Wood-street, Cheapside, London, for "the Osborne cravat."

9. *Thomas Lant*, of Birmingham, for a fastening for trouser-straps.

10. *John Masters*, of Welford-place, Leicester, for a calisthenic or exercising cord.

10. *Pemberton & Son*, of Birmingham, for a casement fastener.

16. *W. Baddeley*, of Alfred-street, Islington, for a portable fire-engine (every man his own fireman).

16. *Capper & Waters*, of 26, Regent-street, for a combined jacket and shirt (the Carlisle jacket).

23. *James Nasmyth*, of Patricroft, Lancashire, for framing for a portable steam-engine.

May 24. *John Sutton,* of 42, Stamford-street, Blackfriars-road, Surrey, machinist, for an adjustable inkstand.

24. *J. Harrison,* of 45, John-street, Fitzroy-square, for "the boudoir piano-forte action."

25. *William Brodie,* of Airdrie, tile-maker and engineer, for a tile machine.

25. *Marmaduke Osborn Bergin,* of Cork, for "the automatic fire extinguisher."

25. *Alfred Bird,* of Birmingham, for a filter.

27. *John Davenport,* of 185, Rockingham-street, Sheffield, for an improved graining comb.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th April to the 17th May, 1850, inclusive.

To William Garnett Taylor, of Burton Hall, in the county of Westmoreland, Gent., for improvements in lint and in linting-machines,—which improvements in linting-machines are, in whole or part, applicable to other purposes.—Sealed 30th April.

William Brown, of Airdrie, Lanarkshire, electrician, and William Williams, the younger, of St. Denis, in the county of Cornwall, Gent., for improvements in electric and magnetic apparatus, for indicating and communicating intelligence.—Sealed 2nd May.

George Edmond Donisthorpe and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and heckling fibrous matters.—Sealed 10th May.

List of Patents

Granted for SCOTLAND, subsequent to April 22nd, 1850.

To Thomas Symes Prideaux, of Southampton, for improvements in puddling and other furnaces.—Sealed 26th April.

Charles Cowper, of Southampton-buildings, Chancery-lane, London, for certain improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, and in the distillation and treatment of tar and other products from coal; together with improvements in the machinery and apparatus

employed for the said purposes,—being a communication.—Sealed 26th April.

Lucien Vidié, late of Paris, but now of South-street, Finsbury, French Advocate, for improvements in conveyances on land and water.—Sealed 26th April.

Robert Dalglish, of Glasgow, merchant and calico printer, for certain improvements in printing, and in the application of colors to silk, cotton, linen, woollen, and other textile fabrics.—Sealed 27th April.

Ethan Campbell, of New York, United States, philosophical, practical, and experimental engineer, for certain new and useful improvements for generating and applying motive power, and for propelling vessels.—Sealed 30th April.

Robert Reid, of Glasgow, manufacturer, for certain improvements in weaving.—Sealed 3rd May.

Maxwell Miller, of Glasgow, coppersmith, for certain improvements in distilling and rectifying.—Sealed 3rd May.

Thomas Keeley, of Nottingham, manufacturer, and William Wilkinson, of the same place, framework-knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; and also certain machinery for producing the said improvements, which is applicable, in whole or in part, to the manufacture of looped fabrics generally.—Sealed 8th May.

Peter Armand le Comte de Fontainemoreau, of 4, South-street, Finsbury-square, patent agent, for certain improvements for the production of heat and light; which improvements are applicable to ventilation and the prevention of explosions,—being a communication.—Sealed 9th May.

Ethan Baldwin, of Philadelphia, United States, for a new and useful method of generating and applying steam in propelling vessels, locomotives, and stationary engines.—Sealed 9th May.

Jacob Connop, of Hyde-park, London, for improvements in melting, moulding, and casting sand, earth, and other substances, for paving, building, and various other useful purposes.—Sealed 20th May.

New Patents
SEALED IN ENGLAND.
1850.

To William Gilbert Elliott, of Blisworth, in the county of Northampton, Gent., for improvements in the manufacture of bricks, tiles, and pipes, and other articles, from plastic materials,—being a communication. Sealed 27th April—6 months for inrolment.

Charles May, of Ipswich, engineer, and Robert Leggett, of the same place, foreman of mechanics to Messrs. Ransom and May, of the same place, for improvements in machinery for thrashing and grinding corn; for cutting straw and other similar substances; also improvements in applying steam power to give motion to such classes of machinery; and also improvements in machines for depositing seed. Sealed 30th April—6 months for inrolment.

George Michiels, of London, Gent., for improvements in treating coal and in the manufacture of gas; and also in apparatus for burning gas,—being a communication. Sealed 30th April—6 months for inrolment.

Evan Protheroe, of Austin Friars, in the City of London, merchant, for improvements in the manufacture of oxide of zinc, and in making paints from oxide of zinc,—being a communication. Sealed 30th April—6 months for inrolment.

Robert Dalglish, of Glasgow, in the county of Lanark, in Scotland, merchant and calico printer, for certain improvements in printing; and in the application of colours to silk, cotton, linen, woollen, and other textile fabrics. Sealed 7th May—6 months for inrolment.

Gustave Eugene Michel Gerard, of Paris, in the Republic of France, for improvements in dissolving caoutchouc (India-rubber) and gutta-percha. Sealed 7th May—6 months for inrolment.

George Hurwood, of Ipswich, in the county of Suffolk, engineer, for improvements in grinding corn and other substances. Sealed 7th May—6 months for inrolment.

Joseph Gibbs, of Devonshire-street, Portland-place, in the county of Middlesex, civil engineer, for improvements in artificial stone, mortar, and cements; and in the modes of manufacturing the same. Sealed 7th May—6 months for inrolment.

John Tatham, and David Cheetham, of Rochdale, in the county of Lancaster, machine makers, for certain improvements in machinery or apparatus, and operations connected with the manufacture of cotton, wool, silk, and other fibrous substances and fabrics; and in the application of certain materials to the manufacture of textile fabrics. Sealed 7th May—6 months for inrolment.

George Robbins, of Forrest Lodge, near Hythe, in the county of Southampton, Gent., for improvements in the construction of railway carriages. Sealed 7th May—6 months for inrolment.

John Youil, of Ardwick, Manchester, brewer, for certain improvements in machinery or apparatus for washing, cleansing, filling, and corking bottles and other vessels. Sealed 8th May—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for improvements in warming and ventilating buildings. Sealed 22nd May—6 months for inrolment.

Robert Cotgreave, of Eccleston, in the county of Chester, farmer, for certain improvements in machinery or apparatus to be used in draining land. Sealed 22nd May—6 months for inrolment.

Henry Columbus Hurry, of Manchester, civil engineer, for certain improvements in the method of lubricating machinery. Sealed 22nd May—6 months for inrolment.

William Palmer, of 14, Cottage-grove, Bow-road, in the county of Middlesex, Gent., for improvements in the manufacture of candles and candle-wicks; and in the machinery applicable to such matters. Sealed 22nd May—6 months for inrolment.

Jules Frederick Maillard Dumeste, of Paris, for certain improvements in reflectors for luminaries. Sealed 22nd May—6 months for inrolment.

Simon Pincoffs, of Manchester, merchant, for certain improvements in the ageing process in calico printing and dyeing; which improvements are also applicable to other processes in calico printing and dyeing. Sealed 23rd May—6 months for inrolment.

William Radley, chemical engineer, and Frederick Meyer, oil merchant, both of Lambeth, in the county of Surrey, for improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies; in the manufacture and application of them and of their components, and subsidiary products, together with the apparatus to be employed therein to new and other useful purposes. Sealed 25th May—6 months for inrolment.

Edwin Pettitt, of Birmingham, in the county of Warwick, civil engineer, for improvements in the manufacture of glass; in the method of forming or shaping and ornamenting vessels and articles of glass; and in the construction of furnaces and annealing kilns. Sealed 25th May—6 months for inrolment.

John Hickman, of Walsall, in the county of Stafford, clerk, for improvements in the manufacture of cylindrical and other tubes. Sealed 25th May—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in couplings for carriages; and in the attachment of wheels to axles. Sealed 28th May—6 months for inrolment.

CELESTIAL PHENOMENA for June, 1850.

D.	H.	M.	
1			Clock after the ☉ 2m. 35s.
—			☽ rises 0h. 5m. M.
—			☽ passes mer. 4h. 48m. M.
—			☽ sets 9h. 36m. M.
—			Occul. 42 Aquarii, im. 13h. 22m. em. 14h. 35m.
2	7		♀ in Perihelion
	8	11	♃'s first sat. will em.
3	3	47	☽ in □ or last quarter
4			Juno stationary
	8	55	♃'s second sat. will em.
	16	17	♃ in □ with the ☉
5			Clock after the ☉ 1m. 45s.
—			☽ rises 1h. 44m. M.
—			☽ passes mer. 7h. 47m. M.
—			☽ sets 2h. 2m. A.
	10	46	♄ in conj. with the ☽ diff. of dec. 2. 17. N.
6	4	35	♅ in conj. with the ☽ diff. of dec. 4. 33. N.
9	7	17	☿ in Aphelion
	10	50	♃'s first sat. will em.
	18	28	☿ in inf. conj. with the ☉
	19	7	☿ in conj. with the ☽ diff. of dec. 1. 6. N.
10			Clock after the ☉ 1m. 0s.
—			☽ rises 4h. 17m. M.
—			☽ passes mer. 0h. 12m. A.
—			☽ sets 8h. 15m. A.
	7	20	Ecliptic conj. or ● new moon
11	7		☽ in Perigee
	11	32	♃'s second sat. will em.
	16	32	♀ in conj. with the ☽ diff. of dec. 4. 3. N.
13	17	46	♂ in conj. with the ☽ diff. of dec. 1. 16. N.
14			Mercury R. A. 5h. 3m. dec. 18. 48. N.
—			Venus R. A. 7h. 25m. dec. 23. 37. N.
—			Mars R. A. 9h. 20m. dec. 16. 57. N.
—			Vesta, R. A., 8h. 55m. dec. 21. 38. N.
—			Juno, R.A., 12h. 54m. dec. 4. 18. N.
—			Pallas, R. A., 22h. 7m. dec. 12. 43. N.
—			Ceres R.A. 0h. 25m. dec. 8. 42. S.
—			Jupiter R. A. 11h. 6m. dec. 7m. 7. N.
14			Saturn R. A. 1h. 13m. dec. 5. 15. N.
—			Georg. R. A. 1h. 49m. dec. 10. 43. N.
—			Mercury passes mer. 23h. 28m.
—			Venus passes mer. 1h. 55m.
—			Mars passes mer. 3h. 50m.
—			Jupiter passes mer. 5h. 35m.
—			Saturn passes mer. 9h. 41m.
—			Georg. passes mer. 20h. 16m.
15			Clock before the ☉ 0m. 2s.
—			☽ rises 9h. 58m. M.
—			☽ passes mer. 5h. 9m. A.
—			☽ sets Morn.
	15	37	♃ in conj. with the ☽ diff. of dec. 1. 18. S.
	—		Occul. ϰ Leonis, im. 11h. 57m. em. 12h. 47m.
16	10	23	☽ in □ or first quarter.
17	9	36	♃'s third sat. will em.
	10	25	♃'s fourth sat. will im.
20			Clock before the ☉ 1m. 6s.
	—		☽ rises 4h. 0m. A.
	—		☽ passes mer. 9h. 9m. A.
	—		☽ sets 1h. 45m. M.
21	8	0	☉ enters Cancer, Summer com.
	15	10	☿ stationary
22			Occul. 29 Ophiuhci, im. 13h.56m. em. 14h. 52m.
	—		Pallas stationary
24	2	10	Ecliptic oppo. or ○ full moon
	7	51	♀ greatest hel. lat. N.
	10	31	♃'s third sat. will im.
25			Clock after the ☉ 2m. 10s.
	—		☽ rises 8h. 53m. A.
	—		☽ passes mer. 0h. 22m. M.
	—		☽ sets 4h. 38m. M.
	8	24	♃'s first sat. will em.
26	16	0	☽ in Apogee
	17	23	Ceres in □ with the ☉
	—		Occul. σ Capricorni, im. 9h. 26m. em. 10h. 37m.
28	17	39	☿ greatest hel. lat. S.
29			Occul. 70 Aquarii, im. 12h. 37m. em. 13h. 47m.
30			Clock before the ☉ 3m. 11s.
	—		☽ rises 11h. 27m. A.
	—		☽ passes mer. 4h. 14m. M.
	—		☽ sets 9h. 32m. M.

J. LEWTHWAITE, Rotherhithe.

THE

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CONJOINED SERIES.

No. CCXXIII.

RECENT PATENTS.

To James Nasmyth, *of Patricroft, near Manchester, in the county of Lancaster, engineer, for certain improvements in the method of, and apparatus for, communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics.*—[Sealed 26th June, 1849.]

These improvements apply principally to machines employed in textile manufactures, and consist in communicating the power requisite for driving each separate machine, or system of machines of the same character or description, by means of a separate and distinct steam-engine, placed in direct and immediate connection therewith; and in so arranging the lever connected with the cock or valve which regulates the supply of steam to the said engine, as to enable the attendant workman to communicate, regulate, and disconnect the power which drives the particular machine or system of machines under his superintendence at the time he is inspecting the operation of the machines.

In order that the nature and object of his invention may be clearly understood, the patentee remarks, that, in the management of the several machines employed in the various processes connected with textile manufactures, it is very desirable that the workman should, at all times, have direct and immediate control over the power which drives the machine or system of machines under his charge; in order that he may be able, at any instant, to set in motion or disconnect the

said machine or set of machines, without in any way interfering with the operations of the machinery adjacent; and also that he may be enabled to regulate the speed of the said machine or system of machines, from the greatest desirable amount of velocity to the slowest degree of motion he may require, whilst the said machines are in motion. These objects have hitherto been but partially attained by certain arrangements and modifications of connecting and disconnecting apparatus, catch or clutch-boxes, &c., which communicate the motion to the several machines from the system of shafting through which the power of the steam-engine is transmitted; but, by the present method of communicating power, the most direct and perfect control is given to each workman over the power which drives the machine or system of machines under his care. This object is effected by simply placing the handle or lever of the cock or valve of the steam-engine so near to the machine which it drives that the attendant, while watching the progress of the operation under his charge, can, at any instant, arrest or modify the velocity of the machine or set of machines under his superintendence.

Another object to be attained by the present invention is, that any particular machine or system of machines may be driven separately, without the necessity of working a large steam-engine, with its train of heavy shafting, gearing, &c.; and also that any number of machines may be connected to, or disconnected from, the driving power, without the liability of breakage or disarrangement (caused by the shock or jerk), which exists, under the present system, when heavy machinery is thrown in or out of gear with the driving power. The patentee suggests that, in the process of dyeing, printing, and many other operations wherein a large quantity of steam is required for heating, drying, and other purposes, the steam should be used at a high pressure for driving the engines, and subsequently passed off to the other processes for which it is required at a lower pressure.

The great importance of the objects to be attained by the improved method of communicating and regulating the power for driving such machinery will, it is said, be at once evident to the practical manufacturer, and may be well exemplified as applied to the machines for printing calico and other similar surfaces, more especially those wherein several colors, forming one pattern, are printed by the machine at one and the same operation; in which, according to the peculiar nature of the work they are intended to perform, it is necessary to adjust and regulate the several parts of the said machine

with the greatest accuracy and delicacy previous to commencing the process of printing; and as the accuracy of the said adjustments is liable to be deranged (especially when such machines are actuated, as heretofore, by means of gearing, which is common to several adjacent machines), it is requisite for the attendant workman to arrest the progress of the machine, in order that he may be enabled to ascertain whether or not the operation is proceeding in a satisfactory manner. In the ordinary method of communicating the power to such machines, by means of clutch-boxes and other similar contrivances, the connecting and disconnecting of the machines is invariably accompanied, more or less, by a shock or jerk, which is sometimes found to have the effect of disturbing the accurate correspondence of the several parts of the pattern, thereby occasioning what is technically termed a "mis-fit," and frequently, if unobserved, spoiling the piece of goods.

By means of the present invention, it is stated, the attendant workman, having, at starting, accurately adjusted the several parts of his machinery, can cause the machinery to commence working in the most gradual and delicate manner, and keep it so moving that he may not only be enabled to examine the accuracy of the process whilst the machine is in actual motion, but also, by reason of the extreme command which he possesses over the velocity of his machine, he may perform the most delicate adjustments of the several parts without totally arresting the progress of the machine. As soon as he finds all the parts in a satisfactory condition and fit state of adjustment, he may gradually increase the speed of his engine to the utmost desirable velocity; and again, when necessary, reduce the same, in order to examine whether the operation is proceeding in a satisfactory manner; and so proceed again, without actually stopping the machine: the effect of which will be that the piece need not be spoiled, as it is now very liable to be; but the work in question may be performed in a more perfect and satisfactory manner, and in a much shorter time than it has hitherto been effected.

In Plate XVI., the invention is shewn as adapted to some of the machines used in textile manufactures. In all the figures the handle or lever by which the workman controls and regulates the supply of steam to the engine is indicated by *a*, *a*. Fig. 1, represents the application of the invention to a calendering machine; fig. 2, shews the same as applied to a mangle; fig. 3, shews the adaptation of the invention to a "padding machine;" and fig. 4, represents the application of the same to a four-color calico printing machine.

The patentee, in conclusion, states that he does not claim, as his invention, any peculiar construction, form, or arrangement of steam-engine, as adapted to the purposes aforesaid; but he claims the improved method of communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics, by placing a separate and distinct steam-engine in direct and immediate connection with each machine or system of machines; and so arranging the handle of the steam-valve or cock that the attendant workman may, at all times, have perfect control over the engine whilst he is watching or inspecting the operation of the machine or system of machines under his charge.—[*Inrolled December,* 1849.]

To William Edward Newton, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for planing, tongueing, and grooving boards or planks,—being a communication from abroad.*—[Sealed 5th October, 1849.]

This invention consists in an improved arrangement of machinery, whereby the several operations of planing, tongueing, and grooving may be simultaneously effected, if required; or, instead thereof, any one of such operations may be performed separately.

In Plate XVI., this improved arrangement of machinery is shewn in side elevation at fig. 1; in plan view at fig. 2; in end view at fig. 3; and in cross section at fig. 4. *a, a,* is the main framing for supporting the several parts of the machinery. Near one end of this framing a pair of carrying-wheels *b,* is placed, and a similar pair of carrying-wheels *c,* is located near the middle of the length of the frame. Over these carrying-cylinders an endless travelling belt or platform *d,* passes, which is formed of plates of metal or other suitable material (the outer surface of which should be fluted), linked together in an endless chain; and the hinge-joints of the platform fit into half-round sockets, formed in the periphery of the wheels *b, c,* as shewn in the enlarged view, fig. 5. The upper part of this platform runs on ways or rollers, affixed to the frame for that purpose, and which sustain it perfectly level. This platform is actuated by a train of pinions and wheels *e, f, g, h, i, j,* which receive motion from any first mover, through a strap on the pulley *c*,* of the main driving-shaft *b*,* on which the pinion *e,* is mounted. Directly over the platform

d, there is another endless belt or platform *k*, of similar construction, but somewhat shorter;—this is geared to the one below, so as to move at the same velocity. Between these carrying platforms the board is made to pass endways to the stationary cutters, hereafter described; and, for this purpose, the two revolving carriers are made to grip the board; and, as they cover a considerable extent of its surface, they will hold it firmly and drive it under the stationary cutters to be planed. In order to admit of materials of different thicknesses being passed into the machine to be operated upon, the upper carrier is mounted in a frame *m*, which is capable of adjusting itself to any thickness of wood. This frame is attached, at either side thereof, to the cutter-frame *l*, by two connecting-rods *n*, *n*, which are placed at such an angle as to create the necessary amount of friction for carrying the wood past the cutters. The frame *l*, which is also adjustable, carries vertical screws 1, 1, at its ends, which screws are in contact with the face of the lower framing *a*, *a*; when, therefore, they are turned, they will raise or lower the frame *l*, as required. This frame is connected to the main framing *a*, *a*, by screws 2, 2, which pass through slotted brackets, forming part of the frame *l*, as shewn in the cross section, fig. 4. In lieu of the endless platform *k*, pressing-rollers may be employed to force the wood under the cutters; and one or more pairs of geared rollers or platforms may be applied to the machine beyond the cutters, for the purpose of conveying from the machine the plank or board, after it has been planed.

The cutters, for planing the upper side of the plank, are eight (more or less) in number, varying according to the purpose for which they are wanted; they are mounted in the adjustable frame *l*, and situated over the inner ends of the platform *d*, or that end which is near the middle of the framing; and they are made similar to those of a common plane. These cutters, which are marked *o*, are attached to cast-iron beds *p*, extending across the machine from one side to the other, and fit into sockets or recesses formed in the frame *l*. Affixed to the frame *l*, on either side thereof, immediately above the recesses for the ends of the beds *p*, is a bar *l**; and through these bars a series of vertical screws *q*, pass, for the purpose of pressing upon the beds *p*, and thereby adjusting the cutters to the proper position for operating. The cutters may either be placed at a right angle to the length of the plank of wood, or at an oblique angle thereto, as may be found most desirable. These beds are formed with varying inclines (see fig 5,), in order to present the several cutters at different

angles to the plank. The foremost cutter is set at the most acute angle to the plank, and the following ones approximate gradually towards a vertical position. Between each of the cutters, and directly in front of their edges, a presser-bar or roller *r*, is provided, to form moveable mouth-pieces to the several cutters. These bars or rollers *r*, are made to press upon the wood under operation, by means of springs *s*, placed between the rigid bars *l**, and the presser-bars; or, if preferred, weights might be employed: they thus are rendered capable of yielding to any inequalities in the wood, and prevent the machine from clogging when in work. If preferred, the springs and set-screws can be placed below, instead of above the cutters, as shewn in the cross section, fig. 6. Instead of employing the screws 1, 1, at the ends of the frame *l*, to regulate its height, the bevil gearing (shewn at fig. 7,) may be employed. In this figure, 3, is a horizontal shaft, mounted in stationary bearings, and carrying bevil pinions 4, 4, at either end, in gear with similar pinions, mounted on the lower end of vertical screw-shafts 5, 5. The lower ends of these screw-shafts turn in socket-bearings, and their threaded ends work through threaded lugs, projecting from the slotted brackets of the frame *l*. When, therefore, the shaft 3, is turned (the screws 2, having been previously slackened) it will, through the agency of the screw-shafts 5, 5, either raise or depress the frame *l*, as may be desired. The screws 2, are then tightened, and the frame is thereby held rigidly in its position. If the plank of wood, under operation, is required to be planed on both sides, a second, but an inverted, set of planes or cutters *u*, *u*, is mounted in a frame 6, and attached to the main framing *a*, *a*. The same frame 6, also carries pressing-rollers *t*, *t*; between which and the cutters the wood is passed to be planed on its under side.

The operation of grooving and tongueing, which is simultaneously carried on with the double planing operation, is effected by a fixed and moveable set or series of side cutters, shewn best in the plan view fig. 2. *v*, is the stationary set of edge-cutters, fixed in the frame 6*; and *w*, is the moveable set, fixed in the sliding-piece 7, (see the end view fig. 3,), through the lower part of which the set-screws *x*, *x*, of the framing *a*, *a*, work, for the purpose of bringing up the cutters *w*, into position for grooving or tongueing. There are two sets of short friction-rollers, that pinch the edges of the board between them: the rollers *y*, are stationary on their shafts; but the rollers *y**, have a lateral motion given to them, corresponding to that of the cutters *w*. The cutters must be

sufficient in number to complete the tongue or groove; and for this purpose eight will generally be required. On these cutters, spur cutters are formed; or, instead thereof, they may be made separate, like those in a carpenter's groove-plane. The cutters may stand in an oblique direction, instead of at right angles to the line of motion, if found desirable; and the two last planes should be double ironed, and be set at about the same angle as a carpenter's finishing-plane. It will be obvious that mouldings of any description that can be executed by a hand-plane may be cut in this machine; and, for chamfered boards, the moveable platform will require to be made inclined on its surface. A blower or brush-roller may be used to clear off the grit from the surface of the board before it reaches the cutters, and also to roll up and clear away the shavings, if necessary; and a circular saw may be used for edging the boards. To sharpen the plane-irons, they can be removed, together with the stocks, and sharpened upon a grindstone or emery wheel, which will give the proper bevil to the plane, and will also curve out the stock, so as to make as little bearing as possible just behind the cutting edge. The frame, in which the stocks are set, is adjusted according to the thickness of the stuff to be worked;—each stock is set in the frame, and adjusted to take off successive shavings till the material is finished to the thickness required.

The patentee claims, First,—the general arrangement of the machinery as above described. Secondly,—causing the top platform, or rollers substituted in lieu thereof, to bind or press upon the plank or board under operation with a force varying with the resistance of the cutters, by means of the links or connecting-rods *n*, for the purpose of forcing the plank under the stationary cutters, as above described. Thirdly,—the use of the stationary cutters in combination with the yielding-bar mouth-pieces, as above set forth. Fourthly,—the adjustable edge-rollers, in combination with the tongueing and grooving-cutters, or other stationary edging-cutters, as above described.—[*Inrolled April* 1850.]

To JOSEPH JOHNSON, *of Huddersfield, in the county of York, bricklayer, and* JOE CLIFFE, *of the same place, ironfounder, for improvements in furnaces, or in the means of consuming smoke.*—[Sealed 12th October, 1849.]

THIS invention consists of an improved mode of constructing furnaces or fire-places, whereby heated atmospheric air may

be admitted to the combustible gases given off during the combustion of the fuel in the fire-place, and allowed to become intimately mixed with such combustible gases, for the purpose of burning or consuming them.

In the improved furnaces, hereafter described, the air to be mixed with the combustible gases in the flue is admitted by an aperture in front, either immediately over the fire-door or at some other part where it may be well heated, and is conducted along a pipe or pipes, passage or passages, situated close under the seating of the boiler, to a hollow arched chamber, furnished with openings for the purpose of discharging the air downwards among the heated combustible gases, as they pass from the fire-place to the flue. Or the atmospheric air is conducted from the entrance opening (which should be furnished with a door) to an arched channel or chamber over the fire-place, where it becomes heated by the fire;—and from this arched chamber the heated air passes down longitudinal side flues, along which it is conducted to the interior of a hollow arch; from whence it issues, in a highly heated state, through openings made in the inner or under side of the arch, and, becoming mixed with the combustible gases which are passing from the fire-place into the flue, it furnishes the same with a proper supply of oxygen to effect the combustion thereof. By this means all the combustible parts of the fuel become consumed, and none but the incombustible gases pass along the flue and out at the chimney. In some cases, in order to keep up a draft, and draw away the incombustible gases from the flue, and also to get rid of the noxious part thereof, a fan or a jet of steam is employed, which draws the gases from the flue and conducts them to a chamber, where they are submitted to the action of water or some other chemical agent, for the purpose of abstracting therefrom and absorbing the noxious matters which they contain, before allowing the remainder to escape into the atmosphere.

In Plate XVII., the improvements are shewn as applied to a large waggon-boiler, and also to a cylindrical boiler, both of which boilers are intended for land purposes;—the improvements are also shewn as applied to a marine boiler. Fig. 1, is a longitudinal section, taken through a waggon-boiler and furnace, with the improvements adapted thereto; and fig. 2, is a sectional plan view, taken at about the line 1, 2, of fig. 1, and shewing the air-chambers, the side channels, and hollow arch, for admitting heated air to the combustible gases. Fig. 3, is a transverse vertical section of the boiler and hollow arch, taken in the line 3, 4, of fig. 1; and fig. 4,

is another transverse vertical section, taken in the line 5, 6, of fig. 1. A waggon-boiler, of the ordinary construction, is shewn at *a, a, a,* and the fire-place or furnace at *b, b.* The fire-bridge at the back of the furnace is represented at *c, c*; and *d, d,* shews an arched chamber, situated above the fire-place, to which air is admitted from the external atmosphere by means of an opening at *e,* in front of the furnace and above the fire-door. This entrance to the arched chamber *d, d,* may be furnished with a door, for the purpose of regulating the admission of air to the chamber *d, d*; from whence the heated air passes into the side passages *f, f,* (shewn best at figs. 2, 3, and 4,) to the hollow arch *g, g.* This arch is constructed of hollow fire-tiles or bricks, and is built up on the hollow channel *h,* which communicates with the side channels or passages *f, f,* (shewn best at fig. 3, and in elevation, upon an enlarged scale, at fig. 5). The hollow channel *h,* also communicates, by means of the hollow tiles or bricks *i, i, i,* with the hollow arch *g, g,* above. The ends of this arch are also open to the side channels *f, f,* so that a perfect circulation of air may take place. The heated air from this arch *g,* rushes out, as shewn by the arrows, through openings *g**, made in the under side thereof, and acts upon the combustible gases that are passing from the fire-place through the spaces *j, j, j,* between the hollow fire-tiles or bricks *i, i.* Upon referring to fig. 3, it will be seen that the side passages are continued beyond the hollow arch *g,* and terminate at a hollow fire-bridge *k,* which they supply with heated air, for the purpose of causing the same to issue into the flue and act upon and consume such combustible gases as may have passed the arch *g, g.* This is a precaution which may be employed at the discretion of the engineer or constructor; but, when it is adopted, it will be found advisable to divide the current of air in the side channels *f, f,* into two parts, by means of a longitudinal partition, shewn at *l,* fig. 2. In cases where it may be thought desirable to increase the draft and purify the products of combustion, the incombustible gases may be drawn from the flue by means of a fan or exhauster, or other means, and conducted into a chamber, as at *m,* fig. 1, where the gases may be operated upon by jets of lime-water, or other chemical agents.

Fig. 6, is a longitudinal vertical section of a cylindrical tubular boiler, with the improvements adapted thereto. Fig. 7, is a horizontal section, and fig. 8, is a transverse vertical section, of the same. *a, a,* is the boiler or water-space; and *b, b,* are the furnaces or fire-places, of which there are two; consequently, all the parts connected with the smoke-con-

suming apparatus are in duplicate. *c, c,* is the fire-bridge at the back part of the fire-place. In this instance, the atmospheric air is admitted to the hollow annular space or arch *g, g,* by means of a channel or flat pipe *e, e,* which is placed along the bottom of the ash-pit. The arched chamber *d, d,* and longitudinal channels or passages *f, f,* of figs. 1, 2, 3, and 4, are therefore dispensed with; and the air is heated, in its passage through the channel *e,* and lower part of the arch *g,* before it passes out of the arch and mixes with the combustible gases. The flat pipe *e, e,* communicates with the hollow annular space or arch *g,* as shewn best at fig. 8. On the under side of the upper part of this arch, openings *n, n,* are made, for the purpose of allowing the hot air to rush out and act upon the combustible gases; and any portion of such gases which may pass through the arch unconsumed, will come in contact with a second current of heated atmospheric air, which issues from the hollow fire-bridge *k,*—it having been supplied to the bridge in a somewhat similar manner to that already described in reference to figs. 1, and 2.

At figs. 9, 10, and 11, the improvements are shewn as applied to a marine tubular boiler. In this instance, the atmospheric air is admitted to the fire-bridge by the pipe or channel *f,* which is preferred to be constructed of fire-clay, and is attached to the under side of the boiler. This pipe or channel *f,* communicates with the hollow annular space or arch *g, g,* which is furnished with holes or openings *n, n,* for the emission of the heated air among the combustible gases, as already described in reference to figs. 6, 7, and 8. The atmospheric air may be admitted to the annular space or arch *g,* by means of a pipe or channel *e, e,* along the bottom of the ash-pit; but it is preferred that the channel for the atmospheric air should be above the fire, when it can be conveniently so arranged.

The patentees claim the heating of atmospheric air by introducing it into a chamber, pipe, or hollow arch, situated either immediately over the dead-plate, or in any other convenient situation above the fire-place, or some other part of the furnace where it may be exposed to a high temperature, and conducting such heated air to a perforated hollow arch or chamber near the fire-bridge, and allowing it to issue downwards from the under side of such arch or chamber, and commingle with the gaseous products of the fuel, for the purpose of supplying them with a proper quantity of oxygen at a high temperature, so that the combustible gases arising from the fuel may be properly consumed, and the temperature thereof

not materially reduced, as has been the case in most of the plans hitherto adopted for supplying air to the combustible gases. They claim particularly the employment of the perforated hollow arch above described, whether the same be used in combination with the above arrangements for heating the air, or other plans be employed to effect the same purpose. They also claim, in combination with the above, the use of a hollow fire-bridge, placed behind the ordinary fire-bridge and perforated hollow arch or chamber; which hollow fire-bridge also receives a supply of heated air in the manner above described, and discharges the same through a suitable opening, for the purpose of effecting the combustion of any of the combustible gases which may not have been consumed by the currents of heated air from the hollow arch or chamber.—[*Inrolled April,* 1850.]

To JOSEPH LOWE, *of Salford, in the county of Lancaster, surveyor, for certain improvements in grates or grids, applicable to sewers, drains, and other similar purposes.*—[Sealed 12th October, 1849.]

THIS invention consists in converting the ordinary grates used in drains or sewers into stench-traps, whereby the effluvia arising therefrom will be prevented from escaping to the surface and polluting the atmosphere. The patentee states, that his improved combination of the ordinary street-grating with the stench-trap not only effectually prevents the escape of any effluvia, but also in a considerable degree checks the downward passage of rubbish, street-mud, stones, and other solid substances which are so frequently swept over and into the gratings; for, instead of passing into and obstructing the drains and sewers, such substances will be deposited in the box-trap of the grid, which can be readily cleaned out by lifting up the hinged grating when required.

In Plate XVII., fig. 1, is a sectional elevation of the improved "stench-trap grid;" and fig. 2, is a plan or top view of the same. *a, a,* is an oblong or other shaped cast metal box, having partitions or dividing plates b^1, b^2, cast or placed in it, and of such suitable depth as to form an air-tight joint when the box is nearly filled with water, as shewn in the figure. The grid or grate *c,* is hinged on to the upper part of the box *a, a,* so that it may be lifted up at pleasure for the purpose of cleaning out the box-trap. It will be seen that, on water or other drainage passing off from the surface

through and down the grating *c*, it will flow under the partition b^1, and over the partition b^2, and pass downwards through the opening *d*, into the sewer or drain; and that the water-sealed joint between the partitions b^1, and b^2, will effectually prevent the return of any effluvia arising therefrom.

The patentee claims the novel and peculiar combination and construction above described and set forth, constituting his improvements in grates or grids, applicable to sewers, drains, and other similar purposes, whereby the ascent or return of any effluvium or vapour is prevented by means of the water-sealed joint between the partitions b^1, and b^2, in the trap-box of the grate or grid.—[*Inrolled April*, 1850.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for an invention of certain improvements in pumps, and in machinery or apparatus for working the same; which latter improvements are also applicable for working other machinery,—being a foreign communication.*—[Sealed 20th September, 1849.]

The machinery or apparatus which forms the subject of the present patent consists of a steam-pump, with its necessary boilers, condenser, and cooler, with a steam and water-gauge, and a water-level attached to the boilers, to prevent explosions.

The pump consists, first, of two castings, similar in shape to two oval dishes; secondly, of a diaphragm, made of metallic or vulcanized India-rubber, or other elastic substance, of the same size and shape as the castings. This diaphragm is placed in one of the castings, and is made exactly to fit it, and extend over the rim or flanges of the dish. The diaphragm is made of two sheets of metallic or vulcanized India-rubber, or other material that will stand the temperature required. Between the two sheets of rubber, a blanket is put; and at the central part of the diaphragm, and opposite to the flat part of the pump, several thicknesses of blanket, with sheets of iron outside, are secured and held by rivets extending through the whole. The other casting is then inverted and placed on the edge of the diaphragm, so that the rim or flange is made to fit on the rim of the lower casting; and the flanges of the two castings are then bolted together with the diaphragm between them. A steam-pump cylinder with its piston or diaphragm, constructed after this manner, is shewn in section at fig. 1, Plate XVIII., which figure also represents the pump in

connection with the condenser. The diaphragm forms a moveable partition between the upper and lower parts of the pump, into which steam is admitted above the diaphragm, and water enters below: the object of the diaphragm is to cut off all communication between the steam and cold water, and between the steam-surface and the water-surface of the pump. The upper half of the pump is kept heated to the temperature of the steam; while the lower half remains at the same temperature as the cold water. The water-supply tube, with a valve upon its mouth, opening into the pump, is shewn at D; and the water is expelled from the body of the pump through valves opening outwards into the water-discharge tube E. It is plain that, if a vacuum is made in the pump while the diaphragm rests upon the bottom, the water will rise into the body of the pump through the valve in the pipe D, by the pressure of the atmosphere (provided the pump is not at too great a distance above the reservoir below); and the diaphragm will thus be forced up to the top of the pump, which will then be full of water. If steam is then let into the pump above the diaphragm, it will force this water out at the valve of the pipe E, and up to a height corresponding to the pressure or expansive force of the steam employed for the purpose. The pump is furnished with a self-acting apparatus, in order to supply and discharge the steam, and to produce a vacuum. F, is a bent lever, that has its fulcrum at I, and works the steam-supply and exhaust-valve *i*, which is formed like the slide-valve of the common steam-engine;—the showering-valve W, of the condenser Q, is worked by the lever F, through the intermediate lever F*. A small tube A, leads from the pump-cylinder into the condenser Q, below. When it is required to start the pump, a valve or cock in this small tube A, is opened, so that it may be blown through; the bent lever F, is then raised, and the valve *i*, is thereby drawn up, so as to open the passage for the steam, which rushes into the cylinder and out through the pipe A, A, into the condenser. The air is thus expelled from the pump, and the upper half thereof heated to the same temperature as the steam. The lever then drops, and this brings the steam and exhaust-passages into connection, and, at the same time, raises the showering valve W, of the condenser, which allows the water to shower down the condenser Q, Q, and condense the steam as it enters from the pump. A vacuum is thereby created in the cylinder B, of the pump, and the diaphragm at the bottom of the pump is forced up by the pressure of the atmosphere on the water beneath,—which water rushes in through the

valve of the pipe D, and fills the pump. As soon as the diaphragm reaches the top of the pump, it strikes the stem S, of the valve *i*, and drives that valve upwards,—thereby cutting off the escape and opening the steam-valve; it also raises the spindle *d*, at the lower end of the bent lever. The steam again rushes in at the valve *i*, forces down the diaphragm to the bottom until it strikes the spindle *d*, which draws down the valve *i*, cuts off the steam, and opens the exhaust-valve, and permits the steam to flow into the condenser: the diaphragm, by its descent, forces the water from the cylinder down the tube E, and, when it rises, water is again drawn in through the valve of the pipe D, to fill the pump.

From the foregoing description it will be seen that, as soon as the diaphragm strikes the spindle S, and raises the valve, so as to cut off the escape of steam, an admission of steam is instantly permitted,—which steam, rushing in upon the top of the diaphragm, will stop its upward progress, and start it back, before the pump has become filled with water, and also without completely opening the steam-valve. To remedy this, a cam-piece P, is held against a pin or stud on the lever F, by a spring G. Some force is required to raise the lever until it passes the point of the cam, at which point it will close the escape-valve: the pump is then full,—the plate on the end of the valve-stem having entered a little recess in the upper cover of the cylinder. The cam-piece P, being drawn forward by the spring, acts against the pin on the lever E, and instantly raises the lever,—thereby drawing up the valve the little remaining distance, and permitting the free ingress of steam to the top of the diaphragm.

Instead of turning the steam-pipe upwards, and allowing the steam to escape into the atmosphere, as is common with high-pressure engines, the exit steam-pipe H, is enlarged, and made to communicate with the condenser, as shewn at fig. 1. Each jet of steam forces out from the condenser all the air and condensed water through the valves at M. The valve W, above is then immediately raised, and a shower of cold water from the reservoir falls towards the valves at M, whereby the steam is condensed, and a vacuum is produced. In this condenser the air and hot-water pumps are dispensed with,—the escape-steam being made to act in their stead.

Fig. 2, represents, in section, another form of condenser, or a modification of that above described. The steam from the cylinder of the engine or pump passes through the pipe W, to the condenser Q, and out through the valve M, and pipe N, carrying before it whatever of vapour or water of condensa-

tion is in the condenser. The cold-water reservoir H, is supplied with cold water by means of a pipe; and by means of a perforated riddle or sieve R, it is distributed over the condenser. When the valve M, below is opened, it drives down the rod *a*, and the lever *b*; by which means the rod *d*, and one end of the lever E, above shewn, is pulled down, and the cold-water shower-valve is thereby raised: the water is allowed to fall through this valve from the reservoir H, into the condenser. The rod *a*, is not connected with the valve M, but plays freely up and down through a guide. As soon as the steam will permit it, this valve M, is shut by a spring *s*; but the valve in the cold-water reservoir above is not closed until the vacuum is complete. When this is the case, it is closed by the lever of the pump; or, if used in a common steam-engine, it may be geared to it, so as to close a short time before the stroke of the engine is completed.

It is intended to use the same water in the boilers over and over again; and for this purpose a part of the water of condensation is employed, and is forced directly into the boilers in a warm state, while another portion of it is cooled and used for condensing the steam by showering down in the condenser. The object of using the same water is to avoid one of the great evils of marine steam-boilers, and, in fact, of nearly all steam-boilers, viz., saline deposits and deposits of lime or mud in the boiler.

The cooler is represented, in section, at fig. 1, for the purpose of shewing the internal arrangement. The lower part of the condenser is connected to the cooler by means of a pipe M*, which is bolted upon the top of the cooler at or near one end thereof. This cooler consists of a series of tubes of metal, standing perpendicularly in a reservoir, which may be eight feet high, four feet in width, and contains a number of tubes, four feet high (more or less). The water falls from the condenser Q, into the reservoir, and stands eight or ten inches in depth above the top of the tubes, through which it passes as it is drawn from below to supply the condenser after it has been cooled. For the purpose of cooling these tubes, all the water thrown by the pump is drawn in through the tube R, and passes through the cooler and out at the tube D, at its opposite end, when it enters the pump. The cooling of the water of condensation will not raise the temperature of the water thrown by the pump more than half a degree.

The part of the reservoir above the top of the tubes J, is three feet deep; and in this part, directly under the opening from

the condenser, stands a small vessel or reservoir L, which receives the condensed steam from the condenser, and from which hot water is drawn to supply the boilers. The part below at X, is one foot deep, more or less. The tube *n*, on the top of the small cylinder *y*, is connected with the same reservoir that supplies the showering-valve of the condenser; and a small quantity of water runs from this, just sufficient to condense the steam that escapes from the condenser. A sheet-iron pipe Z, extending from the reservoir up a short distance, allows steam to pass out of the cooler, in case too great a quantity of steam passes through the condenser uncondensed: this precaution prevents any strain or reaction from taking place.

Figs. 3, and 4, represent a double-action diaphragm pump, capable of being worked by high-pressure steam.—Fig. 3, is an end elevation, and fig. 4, is a longitudinal vertical section of the same. The pump consists of two cylinders, placed side by side. The top part of these two cylinders forms one casting, and the bottom part another casting. The diaphragms of both are formed of continuous pieces, extending across both cylinders, as shewn in the section. To the centre part of the diaphragm-plates are secured the rods *c*, *c*, which act as piston-rods. These rods are connected, at their upper ends, with the beam G, which vibrates upon the shaft K. It will be seen that the action of the diaphragms is alternating, so that one pump is made to draw in while the other is throwing out water. To the extremity of the longer arm of the beam, the fly-wheel crank-shaft M, is connected. The object of this fly-wheel is simply to work the steam-valve S, which is effected by means of an excentric or cam N, on the shaft of the fly-wheel, through the intervention of the rod N*, lever O, and rods P.

The improved boiler, which forms a part of this invention, and which the inventor proposes to employ in conjunction with the steam-pumps above described, is also shewn in Plate XVIII. Fig. 5, is a longitudinal vertical section of the boiler and furnace; and fig. 6, is a transverse section, taken through the line A, B, of fig. 5. The boiler is made of the peculiar shape shewn for the purpose of obtaining sufficient grate-surface. As the boiler is constructed almost entirely of tubes, a great amount of heating surface is obtained within comparatively little space. The fire-place is enclosed between two side walls,—a front wall F, and a back wall W. A row of perpendicular tubes are placed against each side wall, and extend from the ends of the boilers or vessels B, C, above, to

a small cylinder D, placed below the fire-bars, and connected by a tube from D, with the half cylinder or water-chamber E. The fire and heated gases pass from the fire-place in the direction of the arrows up over the top of the back wall and over the upper surface of a flat water-chamber *w*, made of sheet iron. The fire then passes back under this chamber *w*, and over the sides of the water vessels E, made in the form of half cylinders, in which the perpendicular tubes H, are inserted at their lower ends. The fire next passes under these half cylinders or water-chambers, and among the tubes I, that are arranged horizontally beneath them; and, having passed across and among these tubes, it proceeds to the back end of the boiler, where the incombustible gases enter the chimney and escape.

The vertical tubes H, extend from the water-chambers E, to the flat chamber *w*, and from thence upward to the steam-chamber K, above. In place of the flat water-chamber *w*, shewn in the drawing, a horizontal plate of iron (through which the vertical tubes H, should be made to pass) may be employed.

The water that supplies this boiler is pumped in through the horizontal tubes I, which are arranged in a serpentine form. It first enters a tube 1, next the chimney, and running the length of this tube comes back through tube 2; on this side it turns into tube 3, and passes through to the other side in this tube, and back in tube 4;—across again in tube 5, and back in 6; and so on until it passes across backward and forward, several hundred feet in distance. It finally enters the lower part of the opposite end of the half cylinder E. By this means contrary currents of fire and water are established, and the gases from the fire are effectually deprived of their heat.

At fig. 7, an arrangement of apparatus, termed by the inventor "a volcanic steam generator," is shewn in sectional elevation. It may be used either alone or in combination with another boiler; such, for instance, as the one just described. Its object is to raise steam almost instantaneously, to meet any sudden emergency; it will therefore be particularly applicable (when used separately) as a boiler for steam fire-engines. This generator, when combined with another boiler, is connected with the lower and upper parts of the boiler by means of tubes or pipes, furnished with valves. In this boiler, "fire-surface," as it is usually termed, is dispensed with, as the fire is made to blaze directly into the water, and the heat is communicated directly to it, instead of being made

to act upon the outside of the boiler. The generator consists of a strong cylinder A, with a flange on its lower edge. In this cylinder is a fuel-chamber B, which, with the cylinder A, is bolted to a strong foundation-plate O, by bolts passing through the flanges of the same. C, is a tube, extending vertically from the fuel chamber through the top of the main cylinder, and furnished with two large brass cocks D, and E.—L, is a safety-valve, with a spring attached; and K, is the fire discharge-pipe, which conducts the fire to the water-chamber. In putting the apparatus to work, the fire-box B, is first filled with coal, directly under the hopper or tube C; and to the coal a small quantity of nitre and powdered coal is added. In order to ignite the fuel, and start the apparatus, a lighted fuse is dropped down through the tube C, and the lower cock D, is shut. The nitre and coal, immediately upon being ignited, will burn furiously, and the fire and gas will pass over through the tube K, to the bottom of the generator, where it mixes with the water and rises in small bubbles to its surface;—nitrate of soda, cast into sticks, is then dropped into the apparatus, so as nearly to fill the tube or hopper between the two cocks D, and E; the upper cock E, being then closed and the lower one opened, the nitrate of soda will drop through on to the coal. When the pressure begins to fail, a further supply of nitrate of soda is dropped into the fire. Three pounds of this nitrate will burn one pound of coal; and the latter is made to burn faster or slower, according as more or less of the nitrate is supplied. The nitrate is used to supply oxygen to the fuel during combustion; but any other matter, capable of giving off oxygen in like manner, may be used.

In conjunction with the novel arrangement of boiler above described, the inventor employs a steam and water-gauge of improved construction;—it may, however, be applied to steam-boilers of any other construction. The nature of this part of the invention consists, first, in providing an air-gauge, and connecting it with the boiler in such a manner that a column of cold water will always intervene between the mercury and steam, for the purpose of preventing the glass from being broken by the heat, and also to preserve the air in the mercurial tube at a uniform temperature. Secondly, in the combination of the gauge or mercurial tube with a metallic vessel, filled with salt water, and tightly sealed and secured to the flue of the boiler (or other part of the boiler liable to receive extra heat whenever the water falls too low or is driven off from the surface of the flue); the said vessel also being connected, by a metallic tube, to an elastic valve, which, when the heat

is greater in the vessel secured to or in contact with the flue (which will only occur when the water is low), will raise the mercury in the water-gauge, and also the lever of the elastic valve; this lever, at the same time, will raise the steam-valve of the gauge, which operates as a steam-whistle to give warning. Thirdly, in the introduction of a glass tube, constructed so that the area of the bore shall be lessened towards the top, so that the mercury shall rise through nearly equal spaces, by equal additions to the pressure. Fourthly, in lining the cold-water metallic tube with India-rubber, or other elastic substance, to form an interior elastic tube, to prevent the tube from bursting, if the water (when the gauge is not in use) should freeze therein. Fifthly, in providing a thermometer for shewing the number of pounds to be added to, or subtracted from, the scale of equilibrium on the thermometer, for variations of temperature in the air of the gauge.

The principle of this gauge is based upon the providing of a portion of cold water between the steam and the mercury in the tube, and arranging the water with the steam-boiler and the mercury in such manner that the heat shall be applied above the column of cold water in the tube; so that water, being a bad conductor of heat, will transmit the heat downwards very slowly and imperfectly.

Fig. 8, shews the steam and water-gauges combined and applied to the upper part of a steam-boiler. S, is the steam-gauge; W, is the water-gauge; A, is the boiler; and B, is the flue of the boiler. C*, is a metal box or vessel containing water, which box may, if thought desirable, be fastened to the flue, or may be merely suspended a little distance above it, or near to the exposed boiler-surface; that is to say, within an inch or two, as shewn. D, is a metallic tube, extending up from the box C*, into a box *d*, above; this box communicates with a cold-water tube C, which projects downwards in the form of a syphon, and terminates in a box, furnished with an elastic valve F; it also communicates, by means of the box *d*, with the cold-water metal tube G, which intervenes between the mercury in the glass tube W, to indicate the degrees of pressure when the water below in the box C*, gives off steam.

The glass steam-gauge or indicator S, communicates with the top of the boiler by means of the metallic tube E, the box H, and the tube I, which admit steam from the boiler to act on the cold water in the tube I, and thereby indicate the pressure by causing the mercury from the bulb of the glass tube S, to rise therein. The three cold-water tubes I, G, and C, are made of metal, and are lined with metallic or vulcanized India-rubber

or with a metallic India-rubber tube within the metal one. This rubber must be very soft and elastic; and it is made so by being cured at a very low temperature, and should fill half or three-quarters of the area of the tube.

The glass mercury tubes S, and W, are formed so that the area of the bore shall decrease towards the top, so that the mercury shall rise through nearly equal spaces by equal additions to the pressure. In a perfectly cylindrical tube, double the pressure will drive the air into nearly half the space; and, unless the area is so lessened as the mercury ascends in the glass tube, it would rise about two and a half inches between 0 and 10 pounds to the inch; while, between 180 and 190 pounds, it would not rise $\frac{1}{100}$th of an inch in the gauge represented in the drawings. Without this change in the construction of the tube, the difference of 20 or 30 pounds in high-pressure boilers would, with difficulty, be perceived; but, with it, a single pound may be distinguished, which is very necessary where high-pressure steam is used.

L, is the steam-valve and whistle;—it is kept down by the lever M, and weight, in the usual way. There is no certainty in the action of the common steam-valve; but the elastic valve of the water-gauge is so constructed that it can never adhere or stick. The short leg of the syphon C, is filled with oil, kept cool by the water in the other part of the bend between it and the steam. The valve F, consists of a piece of leather *m*, protected from the oil or water below by a piece of bladder, or sheet-lead, or other suitable substance. This leather is laid on loosely, and pressed down into the tubular part of the valve in the form of a dish, as represented in the figure. The ring-plate or cover K, is laid on this, and fastened down by screws; the valve F, is then introduced,—its shoulders being made to rest on the ring, so that it shall not strain, but only touch the leather. An elastic valve is thus produced, which will act with uniform freedom, as it can be acted upon only by cold oil. It suffers no steam to escape from the box C*, in the boiler; so that this box will never, by reason of its exposure to the heating surface, become empty and fail to work. The valve F, is made to vibrate sufficiently to raise the lever N, and, by that means, the lever M, of the steam-valve L; whereby an alarm will be given through the means of the whistle L. The levers N, and M, may be attached together by a strap or sling; but, in the drawing, the lever N, is shewn as acting against the under side of the lever M, and raising the end thereof. The area of the elastic valve F, is much larger than that of the steam-valve L; so that a few pounds

per inch addition to the pressure on the elastic valve will raise the steam-valve L, even though it should have accidentally stuck. By providing a pipe with cold water to intervene between the steam or heat and the mercury, and arranging the said pipe to project below the point where the steam comes in contact with the water, the glass tube will never be broken by hot mercury being forced up its bore and expanding its inner surface more rapidly than the outer; while, without this intervening non-conductor, the glass tube is very liable to be broken, especially if it is made of sufficient thickness to sustain the pressure of high steam. A thermometer is placed between the steam and water-gauges, as shewn in the drawing, for the purpose of indicating the allowance that must be made for the pressure of the air in the tubes at different temperatures. Air, as is well known, is expanded by being heated; and it requires a greater pressure to drive it into a given space when warm than when cold. Eight degrees of temperature makes a difference of one pound in the indication of the gauge; for this reason, the thermometer is added; and the scale is made when the mercury stands at 72°. At this temperature, therefore, the scale is strictly correct;—when it stands at 8° above, or at 80°, one pound must be added to the indication on the scale; at 88°, add two pounds; at 64°, or 8° below, substract one pound; at 50°, subtract two pounds.

The construction of the water and steam-gauges is in part the same. Instead however of the water-gauge W, being connected with the top of the boiler, it communicates with the tightly-sealed copper box C*, before mentioned, as lying in the boiler and on the top of the flue. This box C*, is filled with water sufficiently saturated with salt to prevent it from freezing, and has no outlet except through the water-gauge. The indications of this gauge vary slightly from those of the steam-gauge, for several reasons,—one of which is, that, as the box is filled with salt water, it requires more heat to produce from it a given pressure of steam than from fresh water. As soon as the water falls too low in the boiler, or is driven off from the surface of the flues so that they begin to receive extra heat, the pressure in the copper box lying on the flue will increase rapidly. The water-gauge will indicate that increase, and the alarm-whistle above will sound before the flues receive sufficient extra heat to become dangerous. When the alarm is sounded, the flue caps should be opened immediately, and the safety-valve of the boiler raised, and ten or twenty pounds of the pressure suffered to escape. This will cause the water to rise in foam, and wash off and cool the

surface of the flues. There will be no danger of collapse from the sudden accumulation of steam by the water thus coming in contact with the heated top of the flue, if the alarm is attended to; but if neglected for any length of time, the safety-valve should not be raised, but the fires should be partially extinguished and the pumps started. If these precautions are immediately observed when the alarm is sounded, no danger need be apprehended in any case.

At fig. 9, a somewhat different mode of constructing the glass gauges is shewn. In this instance, instead of filling a metal cup with mercury, a flexible bulb, made of India-rubber, is secured to the end of the glass tube; and this bulb is filled with mercury or colored alcohol. It is enclosed within a metal box or case, into which water, from the tubes G, or I, is admitted, so as to act on and collapse the bulb, and thereby force the mercury or colored alcohol up the glass indicator tube.

At fig. 10, an improved apparatus for ascertaining and indicating the level of water in steam-boilers is shewn. The water-level consists of a glass tube A, connected with the boiler at the bottom, by the bent tube or syphon C, and at the top by another bent tube or syphon D;—these tubes, being both syphons, are filled with cold water, to protect the glass from the heat of the steam and hot water in the boiler. Upon the top of this glass tube A, is fixed a tight copper or cast-metal box B, the bottom of which is circular. The glass tube A, extends up to near the top of the box B, which is full of air; and as the tube A, is open at its upper end, it communicates with the air in the box B. The lower part of the glass tube and the iron tube below (for a short distance) should be filled with colored oil, and the remainder of the tubes filled with water. It is plain that, proper allowance being made for difference in specific gravities of oil and water, the oil will rise to the same level as the water in the boiler. As the pressure of steam in the boiler increases, the air in the box B, is compressed by the water, which rises in the box, but never flows over into the glass tube. It will be seen that cold oil is in the bottom of the glass tube A, and air in the upper part, instead of hot water in the bottom and steam in the top, as in the common form of water-gauge. The size of the box B, must depend on the length and area of the bore of the glass tube and the pressure of steam in the boiler. It should be so large that the air will never be all condensed in the glass tube. One great advantage of this form is, that heavy glass tubes can be used without the liability of being

broken by heat. Another advantage is, that the tube is kept clean inside, so that the height of the water can always be seen.

The patentee claims, First,—the mode of constructing steam-pumps as herein shewn and described, and consisting principally of a chamber or cylinder, divided into two parts by a flexible diapraghm, which is acted upon on one side by the elastic force of steam or other elastic fluid, and on the other side is made alternately to draw in and expel water or other liquid which is intended to be raised.

Secondly.—In reference to the apparatus for working the said pumps, either by means of high or low pressure steam, he claims the construction and arrangement of the parts which constitute the boiler; particularly the employment of the horizontal and serpentine pipes I, below the half cylinders E, whereby the cold water to supply the boiler is conveyed thereto in an opposite direction to the passage of the heat or gases from the fire-place; so that a great portion of the waste heat is taken up by the cool surfaces of the pipes I.

Thirdly.—The construction of condenser and cooler herein shewn, whereby the hot water pump and air-pump, usually employed with condensing engines, is dispensed with.

Fourthly.—Constructing steam and water-gauges in such a manner that, by the intervention of a column of cold or comparatively cold water, or other liquid, between the mercury or indicating fluid and the steam-boiler, the heat from the steam or hot water in the boiler is prevented from injuriously affecting the glass tubes of which the gauges are made. He claims also the employment of the metal box c*, filled with water or other suitable liquid, and tightly sealed; and the application thereof (for the purpose herein set forth) to the flue or other surface that is liable to exposure to an increased temperature, when the water in the boiler sinks below its proper level. And, further, he claims the elastic valve F, and its combination with the steam-valve; and also the indicator tubes or gauges S, and W, formed with a gradually decreasing area upwards, for the purposes herein set forth. He also claims constructing the cold water tubes I, and G, with an interior tube or lining of India-rubber or other elastic substance. And, Lastly,—the method, herein shewn and described, of constructing indicators or gauges, for shewing the height of water in steam-boilers.—[*Inrolled March*, 1850.]

To Osgood Field, *of London, merchant, for improvements in anchors,—being a communication.*—[Sealed 5th June, 1849.]

This invention consists in certain improvements in anchors, for the purpose of preventing cables from "fouling" the same.

In Plate XVIII., fig. 1, exhibits a side elevation of an improved anchor, and fig. 2, is another elevation, taken at right angles to fig. 1.

The first improvement is designed to prevent a cable from fouling on the flukes or arms; for which purpose, guards *a, a,* are secured to the shank *b,* by pin-joints *c, c,* in such manner that they can move freely; and the two guards are connected together by bars *d, d,* so that they will move simultaneously: therefore when one guard is caused to approach the shank *b,* by the fluke on that side entering the ground, the other guard will move towards the outer end of its fluke, and will then be in a suitable position to prevent a cable from fouling that fluke. At fig. 1, the guards are shewn in the positions in which they would be, supposing the right-hand fluke to be in the ground; but if the left-hand fluke were in the ground, the guards would be in the positions indicated by dotted lines.

The second improvement consists in the application of guards between the ends of the stock and the shank or crown, in order to prevent a cable from fouling the stock. The guards (which are shewn at *e, e,*) may be permanently fixed between the ends of the stock and the shank or crown; or they may be connected therewith by means of bolts or other means which will admit of the guards being removed when required.

The last improvement consists in applying a guard *f,* to the crown of an anchor, to prevent a cable from fouling by passing under the crown. The guard *f,* consists of an open frame, attached to the crown, as shewn, or in any other convenient manner, so that it will fall over and form an incline, which will cast off a cable and prevent it from passing under the crown of the anchor. The cross bar f^1, is attached to the frame to ensure the falling over of the guard.

The patentee does not confine himself to the above details. He claims, Firstly,—constructing anchors with guards *a, a, d,* whereby, when the lower flukes are buried, the upper flukes and arms will be guarded, so as to prevent cables fouling. Secondly,—the manufacture of anchors with guards *e, e,* between the stocks and shanks or crowns, to prevent cables

fouling the same. Thirdly,—the manufacture of anchors with guards *f*, to prevent cables passing under the crowns of such anchors.—[*Inrolled December*, 1849.]

To SAMUEL BROWN OLIVER, *of Woodford, in the county of Essex, Gent., for certain improvements in dyeing and dyeing materials,—being a communication.*—[Sealed 10th November, 1849.]

THIS invention consists in manufacturing mixtures of the following materials, to be used in dyeing woollen fabrics, or fabrics containing a mixture of wool, viz.:—Sulphuric, nitric, boracic, acetic, arsenious, pyroligneous, oxalic, and tartaric acids—chloride of sodium or common salt—sal-ammoniac—chloride of magnesium—chloride of potassium—sulphate of potash—sulphate of magnesia—sulphate of soda—oxalate of potash—acetate of potash—acetate of soda—nitrate of soda—nitrate of potash—sulphate of zinc—and borax.

The patentee describes seven mixtures, which are those that he prefers to use; but he does not confine himself thereto, as variations in the proportions or substitutions of certain of the materials above enumerated may be made. The first mixture consists of 100 parts of chloride of sodium, 300 parts of water, 10 parts of sulphuric acid, 3 parts of nitric acid, and 1 part of arsenious acid. The second mixture consists of 100 parts of sulphate of soda or sulphate of potash, 6 parts of sulphuric acid, and 2 parts of nitric acid. The third mixture consists of 100 parts of sulphate of soda or potash, 1 part of sulphuric acid, 3 parts of nitric acid, and 6 parts of vinegar (or, instead of the latter, 2 parts of purified acetic acid may be used). The fourth mixture is composed of 100 parts of sulphate of soda or potash, 6 parts of sulphuric acid, and 3 parts of tartaric acid in a state of powder. The fifth mixture consists of 100 parts of nitrate of potash, 30, 40, 50, or 60 parts of sulphuric acid (according to the shade required), and 1000 parts of sulphate of soda or potash. The sixth mixture is composed of 100 parts of the fifth mixture, 3 parts of tartaric acid in a state of powder, and 10 parts of acetate of potash. The seventh mixture consists of 100 parts of sulphate of soda or potash, 4 parts of nitric acid, 4 parts of acetic acid, and 10 parts of tartaric acid in a state of powder.

The first and second mixtures are not to be employed for grain colors, or for any other colors in which solutions of tin are present; but the other mixtures may be employed for all

colors,—including grain colors, or other colors in which solutions of tin are present. The materials of which the mixtures are composed are to be left in contact for several days. The vessels in which the above mixtures, or other analogous compounds, are prepared, must be formed of such substances as will not be liable to be acted on by the materials that are to compose the mixture; and which materials are allowed to act on each other until decomposition and admixture are thoroughly effected. The mixtures may be dried by natural or artificial means, and reduced to a state of powder in a mortar or mill.

The mixtures, above described, are to be used in dyeing woollen fabrics, or fabrics in which a mixture of wool is present, in the same manner as cream of tartar or argol is commonly employed,—the same weight of the respective mixtures being taken as would have been taken of cream of tartar or argol. The mixtures are to be employed with the aluminous or other mordants in the ordinary operations of dyeing. For dyeing dark colors, the mixtures may be used without the addition of other mordants; but, for ordinary purposes, they are employed as substitutes for cream of tartar or argol.

In conclusion, the patentee says that, having described the invention and stated what he considers to be the best materials for the purposes above mentioned, he wishes it to be understood that he does not claim the use of the acids or salts above enumerated, when taken separately; but he does claim, as the improvements in dyeing and dyeing materials communicated to him, the use of such acids and salts, when combined in the manner and for the purposes above described, or when any of them are made to substitute one another in such mixtures for like purposes.—[*Inrolled May*, 1850.]

To ADAM YULE, *of Dundee, master mariner, and* JOHN CHANTER, *of Lloyd's, London, Gent., for improvements in the preparation of materials for coating ships and other vessels.*—[Sealed 1st August, 1849.]

THIS invention is stated by the patentees to consist in "preparing and manufacturing compositions or paints for preserving and protecting ships and other vessels from marine deposits on yellow metal, copper, and single-bottom wood ships or iron."

Four modes of preparing the compositions are described. The first mode is as follows:—Take from eight to ten *parts*

of bullock's gall, to which add about thirty *pounds* of carbonate [qy. carburet] of iron or plumbago in fine powder; mix the same together so as to form a paste; and to this add about four gallons of sea-water, or sufficient to bring the whole to the consistency of paint.

Second mode.—Take thirty pounds of carbonate of iron or plumbago, finely powdered, about three pounds of white arsenic, two gallons and a half of coal-tar naphtha or spirit of turpentine, and from twelve to fourteen pounds of Stockholm pitch; dissolve the pitch in the coal-tar naphtha or spirit of turpentine; and then mix the whole together to the consistency of paint.

Third mode.—The patentees state that, for iron or zinc, they use, as a first coating, a preparation of gutta-percha or India-rubber, together or separately dissolved in coal-tar naphtha or other solvent, so as to produce a composition which may be readily applied with a paint brush.

Fourth mode.—Take ten pounds of carbonate of iron or plumbago, finely powdered, and one pound of white arsenic, mix intimately and add, with the assistance of heat, as much Russian or other tallow as will serve to incorporate them thoroughly. "This is to be applied when hot, and well rubbed with unmixed [   ] till dry."—[*Inrolled Feb.*, 1850.]

To George Edmond Donisthorpe, *of Leeds, in the county of York, manufacturer, for improvements in wheels of locomotive carriages.*—[Sealed 3rd December, 1849.]

This invention consists in constructing the driving-wheels of locomotive engines in such manner that the running surface thereof shall consist of several separate and independent parts, pressed outwards by elastic means, whereby a larger portion of the driving-wheel will be constantly in contact with the rail.

In Plate XVIII., fig. 1, is a side elevation, partly in section, and fig. 2, is a transverse vertical section of a wheel for a locomotive engine, constructed according to this invention. The patentee prefers that the wheels should be of the kind known as solid or disc-wheels, as shewn; but he does not confine himself thereto. *a, a,* are sliding blocks, which constitute the running surface of the wheel, and are constantly pressed outwards by a belt of vulcanized India-rubber *b*; or the means of pressing out such blocks may be varied, and other materials than vulcanized India-rubber may be employed. The blocks are kept in their proper positions around the

wheel by bolts *c*, which pass through slots in the blocks; but other modes of retaining the blocks in their places may be adopted, if preferred. The result of this arrangement will be, that the driving-wheel will bear on the rail to a much greater extent than when the running surface consists of one ring, which practically can only touch the rail at one point or line across its surface.

The patentee claims, as his invention, the manufacture of the driving-wheels of locomotive engines with the running surfaces each made up of several separate and independent parts, pressed outwards by suitable elastic means, and thus to obtain more extensive bearing surfaces.—[*Inrolled June,* 1850.]

To Jean Baptiste Ecarnot, *of France, for improvements in the manufacture of sulphurous, sulphuric, acetic, and oxalic acids, and nitrates.*—[Sealed 10th December, 1849.]

The patentee commences his specification by saying that, according to the ordinary method of manufacturing oxalic acid, if nitric acid is brought in contact with a body which gives birth to oxalic acid, binoxide of azote (binoxide of nitrogen) will escape; and which, combining with the oxygen of the atmospheric air, changes into hypoazotic (hyponitrous) acid, and is generally lost. Sometimes the vapours are employed in the manufacture of sulphuric acid. The improvement consists in converting the binoxide of azote into hypoazotic acid, in close vessels, with an injection of air, which may be introduced by a blower or other suitable apparatus. Hypoazotic acid is decomposed by water or steam into nitric acid and binoxide of nitrogen; which latter, coming in contact with a new injection of air, will again be converted into hypoazotic acid. The form of apparatus for regenerating azotic acid may be varied, so long as the principle of injecting air and water be retained. The patentee prefers to employ, for this purpose, a column composed of tubes of earthenware, well luted. The binoxide, as released, is conducted through glass tubes into the upper part of the column; the oxygen is supplied to the binoxide by a blowing machine; and steam is admitted from a boiler, together with a small supply of water from a reservoir at the upper part of the apparatus. The chamber in which the acid is regenerated should be filled with a porous substance, to facilitate the combination: the patentee prefers to use pumice-stone, in pieces of about the size of an egg. The azotic acid, thus produced, is of a specific gravity

of from 8° to 12° of the areometer of Beaumé, and, when properly concentrated, may be used for new combinations.

The above process of employing atmospheric air is also to be used in the manufacture of sulphuric and sulphurous acid, and also in the conversion of alcohol into acetic acid; but when it is employed for this latter purpose, the air should be heated to about 120° or 130° Centigrade: at this temperature the oxygen combines with the hydrogen of the alcohol, and converts it into acetic acid. The apparatus for carrying out this operation may be varied; but the patentee prefers to use a copper tube, filled with pumice-stone, into which he introduces heated air and alcohol in a state of vapour; and he afterwards condenses the product.

To manufacture sulphurous acid, according to this invention, the sulphur is heated in a retort until it is nearly in a state of fusion, and heated air is injected, in proportion to the surface of the sulphur, by means of a double air-pump; and the acid, thus obtained, is passed into water, or it is brought into contact with a base to produce a sulphite. Sulphuric acid may be produced by subjecting the sulphurous acid (obtained in this manner) to a further injection of atmospheric air and steam in an upright tube filled with pumice-stone.

To manufacture nitrates, a binoxide of azote is disengaged and treated according to the process above described of making oxalic acid.—[*Inrolled June*, 1850.]

To HENRY ROBERTS, *of Connaught-square, Hyde-park, Gent., for improvements in the manufacture of bricks and tiles.*—[Sealed 15th December, 1849.]

THIS invention consists in manufacturing bricks and tiles, whether hollow or not, of certain peculiar forms, suitable for obtaining good bonding without the use of "headers," and for avoiding vertical joints which pass directly through a wall.

It has been before proposed to employ hollow bricks and tiles in building walls; but the adoption of the same has been prevented either by the unfitness of such bricks or tiles to produce good bonding with perfect joints and similarity in appearance to common brick-work, or else by the retention of the objectionable medium of communication between the external and internal surfaces of the wall which is afforded by heading courses and by vertical joints passing through the wall. Now, this invention is designed to obtain good bond-

ing without the use of headers and without vertical joints passing through the wall; as, in order that the wall may be perfectly dry, there should not be such a medium of communication between the external and internal surfaces of the wall.

In Plate XVII., fig. 1, is a front view of three courses of the improved bricks or tiles; figs. 2, 3, 4, are transverse sections of parts of three walls built with the improved bricks or tiles; and fig. 5, is a sectional plan view of a wall, with perforated jamb and quoin bricks,—which jamb and quoin bricks are not claimed as new. The improved bricks or tiles are made (as in the ordinary mode of manufacturing hollow tiles) by passing brick or tile earth through an orifice, and using an internal core or die of such form as may be desired. The shape of the hollow exhibited in the Plate is preferred; but it may be varied, so long as the external figure of the brick or tile is of the form shewn, or of such other form as will secure a longitudinal bond. Fig. 6, is a transverse section of two bricks, differing somewhat in shape from those shewn at figs. 2, 3, and 4, but suitable for obtaining a like bond with freedom from vertical joints through the wall. The bricks or tiles, producing the bond invented by the patentee, lie longitudinally in the wall; and the bond is formed by the alternate or parallel courses of bricks overlapping with a square, rebated, or chamfered joint, and with a level, a sunk, or a bevilled bed. By thus laying these bricks in courses, all vertical joints, passing through the wall, are avoided; consequently the chance of any moisture being transmitted through the mortar is greatly diminished, if not altogether prevented; and great facility is also afforded for the introduction of wall-plates, joists, and other timbers, without interfering with the hollow character of the wall or diminishing its strength. When the mortar, which is to be used in building the wall, is of a very porous nature, a projecting fillet may be formed on the brick (as indicated by the dotted lines *a*, *a*, in the enlarged section, fig. 7,), to check the transmission of moisture through the horizontal bed.

The patentee claims the manufacture of bricks and tiles, whether hollow or otherwise, of the forms shewn, suitable for obtaining good bonding without headers, and for avoiding vertical joints which pass directly through a wall, as above explained.—[*Inrolled June,* 1850.]

To Henry Attwood, *of Goodman's Fields, in the county of Middlesex, engineer, and* John Renton, *of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch.*—[Sealed 13th Sept., 1849.]

This invention consists in separating starch from the other matters with which it is combined in farinaceous and leguminous substances, by a more expeditious process, and by the employment of cheaper agents than those heretofore used.

The patentees, by way of illustration, describe their mode of manufacturing starch from rice, which is as follows:—They take whole or broken grains of rice (with or without the husk) or rice flour, and throw the same into a suitable vessel, into which they pour a sufficient quantity of a solution of lime and chloride of sodium or common salt to cover the whole of the rice: *i. e.*, about 26 gallons of the solution to each hundred-weight of rice. The solution is prepared by mixing 100 lbs. of quicklime and 30 lbs. of common salt with 500 gallons of water (although the patentees do not confine themselves to these proportions); it is then allowed to settle; and when it has settled, the clear top liquor, only, is drawn off for use. The rice remains immersed in the solution for about six hours (being stirred every half-hour); after which the solution is drawn off by suitable taps, and the rice is covered with a fresh quantity of a similar solution; the rice then remains subject to the action of the solution for six hours (being stirred every half-hour); and at the expiration of this period the solution is drawn off, leaving the rice ready for grinding. The rice is ground in the usual way; then it is introduced into a "rousing" vessel, in which it is covered with a suitable quantity of the above solution, and well stirred or roused for two or three hours; and from this vessel the rice is transferred to a separating vessel or vessels, wherein it is left to stand for about six hours, in order that the starch may be separated from the gluten with which it is combined: the patentees state that, for the purpose of saving time, they generally perform the stirring or rousing process the last thing at night, so that the separation may be effected before morning. On examining the separating-vessel or vessels, a thick creamy matter will be found at the bottom, which is the starch mixed with a portion of fibrine, while the gluten floats near the top of the liquor. The liquor is to be drawn off as close as may be to the creamy deposit; the vessel is to be filled with cold water, which, after a little time, is also drawn off; and then the starch or starchy matter is to be separated

from the fibrine, with which it is intermixed, in the usual way adopted by rice-starch manufacturers. To facilitate the separation of the starch from the fibrine, the patentees sometimes employ a sliding or telescopic tube, placed vertically over an outlet at or near the bottom of the vessel, and so that the upper end of the tube can be gradually depressed until the whole of the starch floating in the water has been run off from the fibrine, which descends towards the bottom.

The moist starch is run into a receiving or filtering vessel, which is furnished with a false bottom or side, consisting of two plates or pieces of perforated zinc, woven wire, or other suitable material, with an intermediate sheet of cotton, linen, or similar fabric; and the space between the bottom or side of the vessel and the false bottom or side is connected by a pipe with an exhausting pump. The pump being set to work, when the starchy matter is run into the receiving or filtering vessel, it draws off all or most of the excess of water with which the starch is charged; but it also draws off, along with the water, a portion of starch, which the meshes of the false bottom or side have failed to intercept. The pump is therefore caused to discharge the water into a long shallow trough, or a series of shallow troughs, communicating with each other, in order that the starchy water may have to flow a long distance before it is allowed to run to waste, and may, during its progress, deposit the whole of the remaining starch. For this purpose the trough or troughs should be placed so as to cause a continuous but very gentle flow,—say at an inclination of about 1 inch in 100 feet;—the width of the troughs should be in proportion to the quantity of water; and the depth should not exceed 4 inches: the patentees have found that in a run of about 300 feet, the water will come off perfectly clear and free from starch. The whole of the starch is now ready for "boxing;" and after this it is to be dried in the ordinary way.

The patentees state that, by means of this invention, they can advance the manufacture of starch in about 48 hours to the same stage which it now takes about 132 hours to arrive at by the ordinary process; they obtain, besides, an increase of from 6 to 7 per cent. in the quantity of starch produced; the starch is also purer than any obtained by means of a caustic alkaline or acid solution; and it is fitted for all purposes to which wheaten starch, produced by fermentation, is generally applied. They prefer to use the solution of lime and salt cold; because a larger quantity of lime can be dissolved in cold than in hot water; and because, also, the risk of fer-

mentation is thereby diminished. Starch, of a good quality for some purposes, may be made by using solutions of lime alone, in the manner above described; but, in this case, the solution of lime is made with cold water, and used in that state only; and they confine their claim to the use of it in that state. The solution of lime and salt, before mentioned, may be used, with the like good effect, in manufacturing starch from rye, beans, peas, and other leguminous substances, and in the preparatory steps of the manufacture of other like articles of commerce, such as dextrine or British gum.

The patentees do not claim the whole of the details of the above method or methods as being new; neither do they claim the employment of pumps or telescopic tubes to collect the starch; but the improvements which they claim, as their invention, are as follows:—First,—the employment of a solution of lime in conjunction with chloride of sodium or salt in water, as before described, in the manufacture of starch and other like articles of commerce, and in the manner before described, and that either before or after the rice is ground, crushed, or broken. Secondly,—the employment, in the manufacture of starch, of lime-water, prepared from lime and cold water. Thirdly,—the employment, in the manufacture of starch, of the use of long shallow troughs, in connection with the exhaust pump, for the purpose of depositing from the water, discharged by the pump, any remainder of starch, as hereinbefore described.—[*Inrolled March,* 1850.]

Scientific Notices.

ON THE PROPOSED EXHIBITION OF THE PRODUCTS OF INDUSTRY OF ALL NATIONS.

NO. II.

WHATEVER opinions may exist as to the policy of instituting an exhibition of the world's industrial products in the coming year, one thing is quite certain, viz., that Great Britain is pledged to the scheme; and that, therefore, the national honor is concerned in its being fairly carried out. It would be idle, after invitations have been sent to all the countries under heaven to compete with us in every branch of our manufactures, to think that we could creditably withdraw from the contest which either our presumption or generosity has provoked; or that, by a studied indifference to the progress of the affair, we could excuse ourselves in the eyes of the world from the

discredit of a defeat which we are apparently courting. It is but too evident that the proposed exhibition, which, when first announced in a tangible shape, was hailed by the principal merchants and manufacturers of the United Kingdom with an amount of satisfaction that left no doubt of their earnest co-operation as a body, is now but a dead letter in the eyes of a large number of that opulent and enterprising class; and that, as far as the manufacturers of the north are concerned, the evidence of English skill and ingenuity is likely to be wanting at the great gathering of 1851. Whether we rely upon our private information, or look to the returns of subscriptions for defraying the expenses of the exhibition, recently made by the local committees established throughout the country, we come alike to the conclusion, that, with respect to the scheme for the carrying out of which the Royal Commission was appointed, apathy reigns throughout the manufacturing districts; while we know, from as clear evidence as language can furnish, that the agricultural interest is almost to a man opposed to it. Can Court influence triumph over such a host of insincere friends and determined enemies? and yet it is apparently by that power alone that the honor of the country, as regards this transaction, is to be preserved. On examining the printed list of subscriptions, bearing date May 27, we find that £61,700 have been collected; a large sum certainly, taken abstractedly, but altogether unequal to the object for which it is intended, and perfectly insignificant when the means employed for raising it are taken into account. It is not so much from the inconveniences which a deficiency of funds may occasion that we fear the failure of the enterprise which was so auspiciously started under Royal patronage, as from the inanition of the parties who alone are able to ensure its success: the pecuniary matters might be easily arranged; but who but the real possessors of the industrial treasures of the country can give the word to spread them before the world's admiring gaze? A careful consideration of the subscription list is valuable, we think, as an index to the feeling existing in different districts with respect to the proposed exhibition; and as such we will proceed to analyze it briefly. We have already said that the gross amount collected up to the end of May was £61,700; now, although this sum may have somewhat increased during the succeeding month, yet we apprehend that, in the relative amounts obtained from the several localities, no changes will have taken place sufficient to invalidate the justice of the inferences which we may draw from our enquiry.

The first fact that meets us is, the extraordinary prominence which London (a city that can boast of no manufactures beyond those to be met with in every country town) holds in the subscription list;—for, whereas Manchester (the head quarters of the manufacturing interest) has, in furnishing the largest sum of any provincial town, presented £3,500 to the fund,—London has given the large amount of £24,800. This looks as if the citizens were in earnest, or, at least, indicates that some persuasive power has been at work; but, if we include, as we should do, within the term London, the City of Westminster, the Borough of Marylebone, Kensington, &c., and also take into consideration the subscriptions raised by public and private societies in the same locality, we shall find that no less than £33,500, or more than one-half of the whole sum raised throughout the United Kingdom for the promotion of the industrial exhibition, has been obtained in the metropolis. This fact, doubtless, admits of an explanation, although doubts may exist of its nature; but, while we reject the suggestion volunteered by Lord Brougham of intimidation, we cannot embrace the opposite belief of special advantages resulting to the metropolitan traders from the location of the exhibition. To nullify the existence of such selfish views, it is enough to call to mind the discussion which has arisen respecting the site of the building; for the proximity to a bone-boiler's establishment, or a gas-house, could not be more earnestly shunned than is the invasion, by the exhibition of industry, of the threatened districts dreaded by the inhabitants of those localities; indeed, it now seems quite within the verge of probability that Battersea Fields will be honored as the neutral ground on which the lions and lambs of the industrial world are to meet in peace and amity. To pursue our enquiry,—Birmingham (which, so recently as last year, made a most praiseworthy effort to collect, under one roof, the best examples of native industry) might be supposed to appreciate, in its fullest extent, the importance of a good display of our skill when placed in juxtaposition with that of other countries; but we would ask, is the existence of such a feeling evinced by the subscription of £641 to the general fund? There is, evidently, something to be explained, when we find a large town in one year willingly subscribing its thousands for the carrying out of a design which, in the succeeding year, it virtually black-balls by presenting the paltry sum just mentioned. If this were but a solitary instance of withholding assistance from the great exhibition, it might possibly be laid to the account of some private pique, or other insignificant cause,

although it would be difficult to understand how a trifling circumstance could produce the amount of unanimity among 183,000 persons, requisite to resist the blandishments employed by the touters of the Royal Commission. We are, however, relieved from the trouble of reconciling ourselves to this solution of the seeming enigma, by perceiving that the subscriptions from Manchester, Liverpool, Glasgow, Edinburgh, and, in fact, all the large towns, fall proportionably short of the amounts expected. The Manchester return of £3,500 is principally due, as is well known, to some half-dozen gentlemen, who, at the first blush of the business, were about to enter into it with the spirit for which that locality is so deservedly famous; but the mass of the people—the 295,000 inhabitants of the Borough (to quote from the census of 1841; now, perhaps, some 100,000 short of the actual number) have remained indifferent spectators of their more eager fellow-citizens' generosity. Again, in Liverpool (reputed the most wealthy place in the kingdom, after London, and containing upwards of 286,000 inhabitants) we find a sum (£827) raised, which barely doubles that of the little town of Windsor, with its population of 7000; while Edinburgh, numbering a population of 225,000, only surpasses the subscription of Windsor by £61.

Now it would be folly to suppose that there is a shrinking on the part of the industrial community from measuring their strength on their native soil with foreign rivals, or that this deficiency of funds is due to the score of parsimony; we are, therefore, driven to seek another cause,—and this, we think, may be found in the mode of conducting the arrangements for the exhibition. At starting, it was proposed that not less than £20,000 should be distributed as prizes to the most deserving exhibitors, and that in sums of considerable magnitude. The idea of getting a share in this lottery was too tempting to be neglected by the multitude; and a large amount of enthusiasm was immediately created thereby. But wiser and cooler heads, affecting to doubt the policy of this proceeding, soon worked a change in the opinions of the Commissioners, and induced, if not an abandonment, at least a temporary withdrawal of this part of the scheme, and, in lieu thereof, the distribution of honorary medals; which change quickly brought down the enthusiasm to zero, where it still remains. This mistake was, however, of little moment, as neither the giving nor the withholding of money-prizes would materially affect that interest which, for the successful prosecution of the scheme, it was well known

there was a necessity to secure; but a far more serious blunder occurred in the choice of men to act as the Executive Committee: it is to this cause, as we believe, that the too evident symptoms of failure of a project, which, for its nobleness of purpose, does honor to its originators, are attributable. In touching on this subject, our desire is not to decry a set of persons, who are, doubtless, respectable in their several vocations, or to deal in unnecessary personalities, however much the presumption of the Executive Committee, in thrusting themselves into their present position, deserves censure; but, holding, as they do, a public and responsible office, we feel perfectly at liberty to discuss the question of their suitability for the post they occupy. The labors of this Committee demand, as we believe, a combination of powers rarely to be met with in the same individual; for, in addition to a thorough knowledge of the mode of conducting business transactions, each member should possess an intimate knowledge of the various branches of manufacturing industry, and also an acquaintance with the fine arts, so as to deal, in a comprehensive spirit, with the variety of matters brought under his notice. It has been said that eminent engineers, from their practical knowledge in mechanical matters, and the responsible position they hold in society, were best fitted for this office. In the absence of men better qualified to fulfil the varied duties of acting commissioners, we should, in concert with the manufacturing interest generally, have been well satisfied with such a selection; but it still remains to be discovered what are the qualifications of those who now hold the appointment, and with what views they forsook their respective private callings to devote their whole time and energies to the intended exhibition. Of the five Commissioners who were appointed, Mr. Stephenson, as is well known, immediately resigned,—leaving a compact clique of four and a secretary, knit together by family ties and personal friendships; and capable, therefore, of making things work smoothly and to their hearts' content. As respects the confidence which these gentlemen are calculated, individually, to inspire, the local committees of Birmingham and Manchester, not to mention those of other places, have had sufficient evidence; for, in assisting at their inauguration, the opportunities presented to the Executive Committee of exhibiting their abilities was not neglected; and the opinions then formed respecting them have been more than confirmed by their subsequent proceedings. In the metropolis, where so much talent of all kinds lies neglected and unknown, they have been less fortunate in opportunities of displaying their powers; and therefore it is, we presume,

taken for granted that they are just the men who should have been selected for the office. As, however, we retain the old-fashioned belief that there is no royal road to learning, and that a sudden desire for knowledge will not instantly impart what has heretofore demanded the study and experience of years to acquire, we cannot clearly understand these gentlemen's qualifications. It may, doubtless, require great erudition and patient application, coupled with good eyesight, to fathom the meaning and transcribe the language of crabbed and illegible mouldy parchment records; but how these valuable possessions are to be made available by placing their owner on the Executive Commission we are at a loss to comprehend. In like manner do we fail to perceive the mode of employing that legal skill which was found equal to the preparation of the memorable document which was to have converted the intended exhibition of nations into a private speculation. There may have been good reason for impressing the services of a gentleman of literary attainments; for doubtless there is much and intricate correspondence to be carried on, which would require considerable tact, even if judgment were not wanted; but for our own parts we should scarcely have selected a reviewer of romances and a writer of absurd and fulsome criticisms upon art. With respect to the fourth of these worthies, we must acknowledge that some shrewdness has been shewn in his appointment; for an active life, spent in performing duties much akin to those which he has undertaken to discharge, will add immensely to the value of his services. The preparation, for instance, of the catalogue of the exhibition (the difficulties of which would be quite appalling to the uninitiated) will, doubtless, under his practised hand, proceed with dispatch, and afford a happy example of judicious systematic arrangement. Our only fear is, that our fourth Commissioner, when the vast building is decked out with the splendid products of the industrial world, and crowded with admiring and distinguished gazers, may, in an enthusiastic moment, feel the old inspiration come upon him,—seize the nearest substitute for an auctioneer's hammer, and commence knocking down the goods, to the astonishment of the spectators.

With regard to the motives which induced the Executive Committee to take upon themselves the responsibilities of their office, we must conclude, in the absence of evidence to the contrary, that patriotism alone could have actuated them; for what recompense is a temporary salary of £800 a year and a little private patronage compared with what they have relinquished? It was, therefore, hard upon them when the

government broke in upon the little clique by the appointment of Colonel Reid as their chairman; because it implied a want of confidence in their measures, and tended to strengthen the vague suspicions which the local committees had formed on the subject. In bidding adieu to these gentlemen for the present, we beg to tender them our sympathy, with a promise that our assistance shall not be wanting in furthering what we must all desire in common, viz., the success of the intended industrial exhibition.

THE LAWS FOR THE PROTECTION AND ENCOURAGEMENT OF INVENTIONS.—*Financial Reform Tract, No. 22.*

SLOW as is the progress of the Patent Law Reform movement, we are not without frequently-recurring indications that our exertions, though at present barren of result, have not been made in vain. The provincial press has recently given proof of an earnest desire to assist in the emancipation of the inventor from the trammels with which he is beset; and now we have the satisfaction of announcing the acquisition of a new and powerfully ally in the Financial Reform Association. By a recent publication, (Tract No. 22), of that body, we are presented with a clear and concise exposition of the nature and bearing of the patent and registration laws, as viewed by men who are capable of looking honestly at a question which has been too often shunned, from a fear of its perplexing details, but which, when stripped of extrinsic trappings, presents no difficulties incapable of solution by any person possessing an average capacity. The author, who, by the way, appears to have a comprehensive knowledge of his subject, touches upon the most prominent defects of the present system of granting patents (details of which have been given, from time to time, in this Journal), and attempts to shew that that the oppressive tax put upon the inventor's ingenuity goes to enrich sinecure placeholders rather than add to the national purse. We must, for the present, pass over the argument whereby he arrives at the conclusion, that out of £53,000, which is about the sum annually paid for English patents, only £18,000 finds its way into the treasury; and indeed omit all notice of that branch of the subject which refers to patent protection, in order to find room for a lengthy extract relating to the working of the Registration Act, which should just now receive the utmost publicity, as it is understood to be the intention of the Government to pass an Act during the present session for the amendment of the law for granting copy-

rights of designs. We would merely remark, in respect to the following extract, that if the opinions therein advanced are decided and severe, our own experience assures us that they are not the less for that reason to be rejected as groundless. The author, after alluding to the tempting offer made to the poor man—of a cheap copyright for his ingenuity, says:—

The Registration Act of 6 and 7 Vic., c. 65, for granting a three-years' copyright for the configuration of articles of utility, presents one of those too frequently-repeated instances of the folly of the framers of our laws, who, in utter ignorance of the specific subject under their hands, proceed to apply remedies for known or imaginary wants, without so much as asking the advice of a single practical man. The crudities of this class of acts are in general pretty freely exposed by the judges when brought under their official cognizance; but, in the case of the act for registering "Non-ornamental Designs," the judicature appointed to decide upon questions concerning the validity and infringements of copyrights, is as unable to give a correct judgment on the law as the framers of it were to form a just estimate of its applicability to the wants of inventors. Incompetence has, in fact, with respect to this act, reigned triumphant; for not only is it framed so as to be scarcely understandable, but it would be difficult to find parties more thoroughly disqualified for the carrying out of its provisions than those who were appointed to superintend its working. In the first place, it attempts an impossibility; for if there be any meaning at all in the act for granting copyrights for original designs having reference to utility, in contradistinction to ornament, the objects intended to be protected thereby must have been such as were protected in no other way, or, rather, which fell short of the scope of the patent laws. The impracticability of attempting to draw a line of distinction between designs for articles of utility and inventions, will be presently demonstrated. But if the Designs Act *is* intended to embrace a portion of those improvements which form legitimate subjects for patents, then is the grossest injustice put upon those, for the most part poor men, who resort to that act for protection. This will be readily seen when it is explained that, in order to register a design, a description and drawing of the improvement for which the copyright is sought must be deposited with the registrar, and, if approved of, it will be recorded in a book open to public inspection. Now, it has been already said that a patentee lodges no description of his invention at the time of applying for a patent; he, therefore, is not bound to the particulars then in his possession, but can insert in his specification whatever improvements he may acquire in the six months allowed him for specifying,—which improvements, if new at the date of his patent, then become his property. To cite an example: If a party, having a patent for "improve-

ments in the production of artificial light," is desirous of enriching his specification with more improvements than his own ingenuity could furnish, he has merely to pay the fee for inspecting all the designs for gas-burners registered since the sealing of his patent, when, by a careful examination of the drawings, he can possess himself of a knowledge of those several inventions, and, without hindrance, include them in his specification. The effect of this is to compel all inventors who would avail themselves of the Designs Registration Act, for protecting their little improvements, to incur the risk of *losing* all right and title to their ingenious contrivances, by following that course which the legislature has provided for their *protection*. To suppose, therefore, that it was ever intended that this act should in any way supersede the patent laws, is to assume that the legislature designed to leave those who resorted to it for protection a prey to heartless injustice. A supposition far more consonant with reason would be, that the object of the act was to protect the authors of ingenious designs, which, from having no reference to ornament, were excluded from the previously existing Designs Act, and which, being of but trifling importance in comparison with "inventions," as the term is generally understood, would not be considered a proper subject matter for letters patent. In taking this view of the case, it is necessary (in order to clear the legislature from the accusation of folly in passing an inoperative law) to presume that the lines of demarcation between mere ornament on the one hand, and invention on the other, can be readily drawn, and that thus the scope of the Non-ornamental Designs Act is clearly ascertainable. A little consideration will, however, shew that there is no foundation for such an opinion. The distinction between designs which are essentially ornamental and those which refer to utility is perfectly evident, because the object to be obtained is different; but where the same object—utility—is common to both, as is the case with inventions and non-ornamental designs, it is obvious that some distinguishing mark must be found before a classification of these two kinds of inventions can be made. Now, the Registration Act, after stating in its preamble that it is expedient to extend copyright protection to designs which are not of an ornamental character, proceeds: "And with regard to any new or original design for any article of manufacture having reference to some purpose of utility, so far as such design shall be for the form or configuration of such article, and that whether it be for the whole of such article or for a part thereof, be it enacted, that the proprietor of such design, not previously published within the United Kingdom of Great Britain and Ireland, or elsewhere, shall have the sole right to apply such design to any article, or make or sell any article according to such design, for the term of three years." &c.

"Form or configuration" is, then, the line of demarcation of this act: that is to say, processes of manufacture are excluded; as also are, practically speaking, arrangements of machinery which

may be changed in form, and yet remain the same as regards their mechanical principles;—these must, therefore, if required to be protected at all, become the subject of letters patent. But, before this Non-ornamental Design Act can be shewn to be a reasonable and just piece of legislation, it will be requisite to prove that *form, having reference to some purpose of utility*, is not within the scope of the patent laws; or otherwise the two species of protection will clash and produce the evil results above mentioned. This position it would, however, be impossible to maintain; for the most casual examination of existing patents will shew that the contrary is the case—that in fact *form*, in many cases, embraces a principle of action, and thus constitutes a proper subject-matter for a patent. To take a familiar example:—Argand gas-burners have heretofore been pierced at the top with vertical holes, for the passage upwards of the gas to be consumed, and they have thus produced a cylindrical flame; but these burners cast a shadow beneath them which it is desirable to remove. A slight change in the form or configuration of the burner will effect this improvement; for by piercing the holes through which the gas issues in a horizontal instead of a vertical direction (the burner having, at the same time, a suitable deflector applied thereto), a horizontal disc flame will be found, which will illuminate the spot immediately beneath the burner. Here, then, is a new manufacture of gas-burner, which is indisputably a patentable subject; and as the improvement is produced by the new form of gas passages in the burner, it as certainly comes within the provisions of the Registration Act. Examples of this kind might be multiplied *ad infinitum;* but enough has been said to shew that the act for registering articles of utility cannot be worked without coming into collision with the patent laws, and thereby endangering the interest of those who have sought the act as a means of protection. In introducing a law like that of the Non-ornamental Designs Act, which, from the novelty of its provisions, could be regarded only as an experiment, it would be but reasonable to suppose that such officers would have been appointed for working it out as were well qualified to judge, not merely of the legal scope of the act, but also of its spirit or intention; more especially as great discretionary power is given to the registrar, which enables him to provide, by bye-laws, in some measure, for the deficiencies and obscurities of the law. An examination, however, of the designs registered will shew the incapacity of the officers appointed to work out the provisions of the act; for many designs have been approved of which were drawn in perspective, although it is expressly stated that "the drawings or prints shall be on a proper geometric scale;" and a great variety of inventions have been passed which were altogether inadmissible, and, although registered, the designs are perfectly invalid.

As respects the judicial provisions of the act, in cases of infringement of copyrights, justices of the peace, having jurisdiction

where the offending party resides, are empowered, when not less than two of them are present, to decide summarily upon cases brought before them, and to fine the infringer in a sum not greater than £30, nor less than £5, for each offence. The prudence, however, of submitting questions of this nature to such a tribunal may be estimated, when it is stated that convictions have been obtained on certificates of registration, when the designs were without the pale of the act.* Fines below the specified sum of £5 have also been imposed; and recently a case was heard while but one justice was present.† The constant occurrence of such irregularities as these, in courts over which *paid* magistrates preside, demonstrates the incompetency of the tribunal for the duties imposed upon it by the Registration Act; for if the acquirements of magistrates educated for the law are found insufficient to guide them to a just decision, it would be folly to suppose that matters of this nature can with fairness be disposed of summarily, when the legal knowledge of country justices of the peace is confined to a smattering acquaintance of the course to be pursued in cases of trespass and assault. The Registration Act of 6 and 7 Vic., c. 65, may, then, from whatever position it is regarded, be fairly set down as a bungling piece of legislation, inasmuch as all its provisions are either defective or impracticable; and, further, it must be considered as incapable of amendment, because it aims at granting protection to a class of subjects which have no distinct and separate existence; for a line of demarcation between "inventions" proper, and designs consisting only of forms having reference to utility, can be no more certainly drawn than between the animal and vegetable kingdoms.

As a remedy for the evils consequent on this crude piece of legislation, the Association propose, what is in fact the only judicious course that can be taken, viz., the total repeal of the Act. We commend their decision to the special consideration of the President of the Board of Trade.

ON THE MANUFACTURE OF BEET-ROOT SUGAR, WITHOUT THE EMPLOYMENT OF ANIMAL CHARCOAL.

BY M. LE DOCTEUR LÜDERSDORFF, OF BERLIN.

In the manufacture of beet-root sugar, the employment of animal charcoal may, according to M. Melsens, be dispensed with, by the application of sulphurous acid, or its acid salts; any other acid will, however, answer the purpose; but, as will easily be under-

* In the case of "Margetson *v.* Wright," the Vice-Chancellor Wigram refused an injunction to restrain the defendant from manufacturing the plaintiff's registered labels, on the ground of invalidity of registration; but, prior to this proceeding, the defendant was summarily convicted and fined for the infringement.

† "Thorowgood *v.* Gallie."

stood, such other acid will be preferred as admits of being readily driven off; as it is found to be a matter of difficulty to deprive the sugar so completely of sulphurous acid as to leave no traces of its smell.

M. Lüdersdorff had occupied himself with this subject as far back as 1837, and succeeded in discovering a process for preparing, without the use of animal charcoal, not only beet-root syrup of excellent quality, but also molasses. He states, that he solicited a patent for this process in 1838, but did not follow it out, as at that time the cultivation of beet-root in the environs of Berlin presented no sufficient advantage over other substances. From the impetus recently given, however, to the manufacture of beet-root sugar, M. Lüdersdorff thought it might be useful to make the process more generally understood, especially as the agent employed by M. Melsens, although attended with serious objections, had given rise to the most brilliant expectations. M. Lüdersdorff therefore furnishes the following explanation of the process by which he imagined he could obtain a satisfactory result, of the nature sought by M. Melsens, and, in fact, partially secured by that gentleman, through the employment of sulphurous acids.

It is well known that beet-root juice is very rapidly oxidized; although colorless when in the root, it acquires, in a few moments after being expressed from the pulp, an intense black color; and soon afterwards, in consequence of the presence of secondary azotous products, viscous fermentation takes place, which not only (if not stopped) would continue until the whole of the sugar was destroyed; but which, even if stopped, renders it extremely difficult, if not impossible, to extract the sugar still present. This appeared to be worthy of attention and experiment,—especially as it was attended with another singular phenomenon, viz., that, on afterwards purifying, by means of lime, the black color of the juice became changed to an intense yellow, which, by concentration, passed to a deep brown,—thus rendering the employment of animal charcoal necessary. The prevention of the oxidation of the juice appeared, therefore, to be the first result to be obtained.

Independently of this, a further examination of the juice shewed that the extraneous matters it contains were divisible into two classes, which have somewhat the character of positive and negative, in relation to each other. By the employment or contact of an *acid*, only a portion of these concomitant matters are coagulated, whilst the others can only be eliminated in a concrete form, by means of an *alkali*,—such as lime. According to the present plan of defecation, lime only is employed. It is therefore evident that the positive extraneous matters in the juice not only remain there, but are, by the ulterior action of the lime, changed into bodies which are no longer susceptible of being coagulated. The elimination of each of these classes of substances, taken

separately, therefore appeared to be the second problem to be solved. Now, to prevent the oxidation of the juice, any mineral acid may be employed. Of these bodies, sulphuric acid appears to be the best suited for the purpose. It is, however, to be regretted that phosphoric acid cannot be employed, by reason of its high price; as the possibility of its entire elimination would greatly facilitate the following operations: sulphuric acid has therefore been preferred.

On mixing with the pulp, freshly rasped, one two-thousandth part of its weight of concentrated sulphuric acid, all oxidation will be prevented, the pulp will remain as white as the beet-root itself, and the juice expressed from it is of a milk-white color. It has also been found, that by the employment of the acid, the quantity of juice obtained from a given quantity of pulp is increased.

The juice thus obtained possesses, as above mentioned, a milky appearance. This cloudiness is occasioned by a light precipitate in the liquid, which deposits very slowly, and consequently requires some medium to carry it down. For this purpose plastic argil is found to answer. About three per cent. of this substance, mixed with the juice, will suffice to throw down the precipitate; and, at the end of twelve hours, two-thirds of the juice will have become as limpid as water, and the whole may be reduced to the same state by filtration. Although, in the space of twelve hours, the action of the sulphuric acid upon the crystallizable sugar was not perceptible, yet it appeared advisable to shorten the duration of its action as much as possible. No other precipitating agent has, however, been discovered, by means of which the acid juice can be clarified even by careful filtration.

In the means of preventing the oxidation of the juice, has also been found, not only that which, like all mineral acids, forms an obstacle to viscous fermentation, but also that by which the elimination of the positive extraneous matters may be effected. The same acid, and, moreover, the same quantity, is sufficient to stop the fermentation, on the one hand, and, on the other, effects the elimination. Now, in order to separate the negative matters from the juice, it is sufficient to have recourse to the ordinary operations of defecation, by means of lime. For this purpose the acid juice is neutralized, by means of milk of lime; and, after heating the juice, the necessary quantity is added, for the purpose of effecting the defecation. M. Lüdersdorff states, that much less time is consumed in this process than in the ordinary defecation of blackened juices, and that the filtration is much more rapid.

The juice obtained after this latter defecation is not absolutely colorless, but has still a yellow tinge. During the boiling which follows this operation, before crystallization, the color is very little deepened; so that a very white sugar is obtained, without employing the least portion of animal charcoal. With respect to the first

syrups, they furnish a full fourth of sugar very easily. It will thus be seen that sulphurous acid, the employment of which is so disadvantageous, can be dispensed with, and good sugar obtained without the use of charcoal; as sulphuric acid, judiciously applied, has precisely the same effect. It must not, however, be forgotten, that the employment of this acid is attended with many disadvantages; amongst others, the difficulty of extracting the sulphate of lime in boiling down the clarified syrup, and especially the clarification of the acid juice, which is effected very slowly. It cannot be denied that this is a serious evil; but, supposing that by perseverance, this difficulty is overcome, there still would remain another question, viz., whether the temperature of 75° Cent., at which the filtration of the juice takes place with rapidity, has not an injurious influence upon the sugar? Lastly, it remains to be ascertained whether phosphoric acid could not be manufactured sufficiently cheap to be employed in place of the sulphuric acid—in which case all the above-mentioned difficulties would disappear.

CEMENT FOR SAVING HAMS.

UNDER this heading the American *Farmer and Mechanic* has the following:—

A new method of saving hams has recently been discovered, and patented by a Mr. Horace Billings, of Illinois, which has proved eminently successful. It consists mainly in employing a cement, which the patentee calls Illinois cement, principally used for this purpose, and which is applied to the covering of the ham,—rendering it impervious, both to the air and moisture, and keeping it perfectly sweet and fresh, even for years.

Having himself been extensively engaged for several years in packing pork in the Western country, and often sustained heavy losses by spoiled hams shipped to New York (or, if saved by excessive salting, they were always sold at about one-half to two-thirds the value of hams cured in that city); and also knowing the fact, that as good pork as could be found in the country was raised in the West, the thought struck him something might be done to bring Western hams on a fair competition with those put up in Eastern cities; and to this end he made a series of experiments, which, although they in part failed, convinced him that something could be done. For the last four years he has been practically at work, and the present year has completed and patented a cement that appears most perfect, and cannot fail of being exceedingly valuable, particularly to the Western country. No doubt is entertained of the saving of millions of dollars to those engaged in packing pork, as all hams put up in this cement not only keep well when packed, but it is known from experience that they *improve* by being kept entirely from the air, as they

thereby acquire a shortness and richness in flavor that no hams put up in the usual way ever attain.

This cement is elastic, and still hard enough to retain a fine gloss and bright appearance; so that the ham coated therewith can be handled without soiling the hands or clothing.

To save a ham for years, it needs only to be salted so as to make it palatable; and, when packed, it loses not a particle in weight; and in the whole experience of the inventor, while perfecting his improvement (having sent to New York some 4000 hams), he has not heard of a single one that proved bad.

As an evidence of the superiority of this plan of saving hams, it is stated that they sold during the last year in New York by the hundred bbls at 11 cents, while Western hams, packed in the usual way, sold at 6 to 8 cents.

The following advantages in packing hams with this cement will at once appear, to any one dealing in Western pork:—

Saving from loss in weight, say 5 to 7 per ct.,
" " bad hams, 10 "

Advantages from the superior quality of the ham, 25 per cent., making a saving, by this invention, of about 40 per cent. on hams; or more than 12 per cent. advantage to those who are engaged in packing the whole hog,—besides the almost perfect safety of dealing in hams put up in this way,—making it a pleasant and safe business.

TRANSACTIONS OF THE SOCIETY OF ARTS.

June 5th, 1850.

A paper from W. H. Smith, Esq., C.E., *was read upon the formation of a Thames embankment throughout the metropolis, having a terraced highway, and comprising a railway arcade, and tunnels for water, sewage, and gas.*

The importance of this subject is universally admitted; but it will be asked, what are the peculiar features of the plans here proposed, and the object of bringing them forward at a period of general depression rather than of enterprise?

Although various projects have, at different times, been suggested for the conveyance into and through the metropolis, of the railways, the sewage, and pure water, and the formation of the Thames embankment, by Mr. Martin, Sir Frederic Trench, Mr. Stephenson, Mr. Walker, Mr. Page, and others, none, like the present, have combined all the great contemplated arterial works in one space—and that space the river-banks, which are not merely useless in their existing state, but highly pernicious to the health of the largest and most wealthy population in the world.

The reason of Mr. Smith's plan being brought forward at this

time is, that on all sides steps are being taken which, if carried out, will place serious difficulties in the way, if they do not prevent the execution of it altogether. Extensions of railways into the metropolis, by tunnels or viaducts, have been proposed, and, in some instances, completed; a commission exists, which purposes to deal solely with the question of sewage; independent pure water companies are now before Parliament; and, lastly, powers are granted to individuals to encroach upon the Thames, and secure the land as private property.

These efforts, however, tend, at the same time, to shew the general wants of the public, and that such have not, as yet, been satisfied, has been owing to the inefficiency of the plans proposed, their expensive working, and the interruption of traffic which would ensue from their execution separately. The present proposal is for uniting in one work these several objects, avoiding the interruption to commerce, increasing the stability and splendour of the whole, and executing it at a minimum expense.

The general arrangement is as follows:—On the top of the embankment, about twelve feet above high water-mark, is the terrace, which is intended exclusively for the public; it is about sixty feet wide, with a parapet and railing next the river; and it is to be connected, by bridges, with all the public approaches. The river traffic would be carried on through transverse arches beneath, which descend to within a foot of high water-mark. These arches would be connected with, and the property of, the warehouses or wharfs on the inner side; they would also be connected with the present streets and other approaches, and with landing-places for steam-boats to run up to at any state of the tide; and there would likewise be openings opposite the entrances of docks,—at which places (as explained by Mr. Smith, in answer to a question) the railway-tunnel, which is beneath the arches, would dip beneath the sill of the dock entrance. Immediately beneath the arches is the railway-tunnel, in the base of which the required culverts for pure water, gas, rain-water, and sewage, would be formed, at about low water-mark.

Although the remunerative advantages of a railway through London are fully allowed, the enormous outlay required in the first instance has been an insuperable difficulty; as the purchase of property alone, for a viaduct, without any work to the extent here proposed, would amount to more than the entire cost of the improvements contemplated; whilst the steam and noise, together with the walling-out, as it were, of property and free intercourse, would be great evils. On the other hand, the objections to tunnels are, the apparently necessary ascent and descent of steep passenger-shafts, and the avoiding of local traffic altogether. Unlike the tunnels of Liverpool, which, being in the sandstone, create much noise and echo, this hollow embankment, or arcade, would be formed in the sound-deadening London clay; and the railway passing through would unite all the existing railways, and, by

branch railways, convey the passengers to any required part of London. This line of railway would have not alone the combined traffic of the present railways, but a great part of that of London itself,—the great objection of the shafts being overcome by a very simple arrangement. Thus passengers might, in the course of a few minutes, proceed from end to end of London; and the two greatest sources of traffic in the world, viz., that of London itself, and the goods and passengers of the united railways, would be secured and conjoined. It is calculated that this part of the proposition would amply repay the entire cost of the works. Some years ago it met with the approbation of one of the first engineers of the day, in connexion with his railway, which had its terminus in London. The tunnel would be as well lit up as, and drier than, the Thames-tunnel. The Adelphi-arches, beneath the Society's house, are an exact illustration of the kind of work, and its position relatively to the houses above. They would, in all probability, from their great extent, be chosen as depôts, as was proposed by one of the existing companies; thereby removing the street traffic of the metropolis, which is at present in a state of collapse.

Pure water would be obtained from the Thames above the region of manufactories, and conveyed by gravitation, in a culvert within the embankment, through London, where it would be pumped up to supply public fountains and every tenement in London,—the present water being employed for cleansing and flushing periodically the existing sewers. There would likewise be spaces for gas-pipes.

The sewage of the metropolis is by this plan intended to be cut off from the Thames, as recommended in the report of the Board of Health, and passed longitudinally under the embankment into the marshes; that on the south side being carried by an iron culvert across the Thames, and joining the northern outfall, which would be carried into the estuary of the Thames, near Hollyhaven, below the influence of the tide, to carry it even as far back as Gravesend. There would be great economy and advantage to the country in employing night trains, into which the sewage might be pumped, and conveyed probably for one halfpenny per ton per mile, increasing threefold the productiveness of some of the agricultural districts around London, and thereby, at one and the same time, enhancing the value of property and lowering the price of food. The Thames, being the lowest, is unquestionably the natural outfall of the metropolis, as is agreed on by those who favor its continued impurities; but it does not necessarily follow that because such outfall is preserved, the sewage should not be shut out from the river; and when it can be done, as it may be said, without cost, in connexion with another work, all objection is removed.

The advantage to the community of retaining the present levels and course of the sewers running transversly to the metropolis is

self-evident: they have occupied many ages, and cost vast sums, in their construction, and would be the natural tributaries to these above-named main sewers, the *cloaca maxima* of the Thames. These sewers would be cemented; so that there could be no more objection to their proximity to the tunnels than to the drains of every house,—indeed, not so much, they being hermetically sealed. All towns above London should equally be compelled to direct their water from an unnatural to its natural destination, from the river to the land, and thereby restore the Thames to that original purity, which, through a succession of ages, had been guarded from pollution with jealous scrutiny, so much so as to admit of its being used as a bathing-place for monarchs.

Thus within the embankment there would be contained a railway, with water, sewage, and gas, as at present under all the leading streets; and they would be accessible, like the sewers of Naples, without disrupture of the street above.

Without more capital than is raised by a railway company, might thus be formed a work peculiarly the property of the public, and causing enormous revenues to be derived from that which at the present moment is either diverted into a false channel, or wholly lost, or most pernicious in its operation, which may be said of the street traffic, the sewage, and the banks of the Thames.

The estimated cost of two embankments from Vauxhall-bridge, on each side of the river, to the West India Docks on the north, and to Deptford on the south, a distance of ten miles, would be £3,000,000. Admitting for a moment the reproductive character of the work may have been overrated, it will be no great misfortune to have laid throughout the entire length of London, the groundwork for what would necessarily follow, a line of handsome dwellings, shops, and warehouses, with a terraced walk, flanked with trees, adjoining the river, forming truly "the lungs of the metropolis;" removing those pernicious banks and shoals so destructive to health; and taking from our spacious river, with its beautiful changing lines, its stately and unequalled bridges, that *backdoor* aspect, which is the wonder of foreigners, and a disgrace to our civilization.

On the other hand, it is fully believed that there are no principles involved in these plans of which our existing engineers have not given us successful examples under greater difficulties. The combination of works would surpass in utility and grandeur the cloacæ and aqueducts of ancient Rome, and it would become a monument of the skill and liberality of the present age.

After the reading of Mr. Smith's paper, Mr. Boccius exhibited a neatly-made model, and explained a plan for collecting and deodorizing sewage, of which he was the author, in connexion with Mr. Stothert. In this plan the existing sewers are also retained, their contents being pumped up into reservoirs, where their solid contents are, by a patented process, deodorized and

precipitated; the water remaining impregnated only with common salt, and being then used for flushing the sewers; and the operations of flushing, pumping-up, and deodorizing, continually succeeding each other. The following extracts from a pamphlet printed by Mr. Stothert for private circulation, will give a clearer notion of the plan.

"If the sewage is no longer to be permitted to empty itself into the river Thames, the first thought that presents itself for carrying it away, is the practicability of constructing, with due regard to economy, a large tunnel, on either side of the Thames, which should intersect all the present drains and allow them to empty themselves therein; such tunnels to be continued respectively to a convenient locality on the east side of London, for receiving the deposit and making it available. The objections to this proposal are—First, that the capacity of the one on the City side would be so great as to induce almost insurmountable difficulties,—endangering the foundations of the bridges, and destroying property from Vauxhall-bridge to the East India Docks. Secondly, that from the little fall occurring between Chelsea and the West India Docks, it would be liable to choke. Thirdly, that of expense, when it is considered that it may have to be taken five or ten miles below the West India Docks.

These difficulties are proposed to be remedied by dividing the distance between Chelsea and the East India docks into compartments; each compartment to have a separate Cornish steam-engine, with cesspool and culvert on one or both sides running into it, into which culvert the drains or sewers in that compartment will open and empty themselves. Each steam-engine, with its own cesspool, culvert, and drains, must be of sufficient power to raise the contents thirty-six feet high, at which height it will flow over into a vertical pipe that will communicate with a horizontal one, that will pass by each engine, receiving its contents and conducting the same away to convenient localities for its deposit. Wherever engines are fixed, they will be connected with a cesspool of suitable dimensions, into which the main culverts running nearly parallel with the river, will empty themselves. These main culverts should be large enough to receive all the drains that empty themselves into the Thames at present, so that the contents of all the present sewers or drains in each division will find their way into the cesspools attached to the engines. The cesspools should be provided with a line of valves opening outwards, above high-water mark, more than equal to one-half the area of the main culverts, so as to provide against heavy storms of rain, or flushing.

The mode of operation proposed is as follows:—To have such a number of Cornish engines fixed on the banks of the river as shall raise the sewage thirty-six feet high, and take the same away by iron pipes to a convenient locality for its deposit. At each situation where an engine is fixed, will be a cesspool with

the main culvert or culverts emptying into it and terminating there,—receiving all the drains that at present exist, between that engine and the next above it. The pipes from all the engines will be continuous, growing larger and larger as they pass each engine towards the place of deposit.

To illustrate the plan, I would suppose a two hundred and fifty horse-power steam-engine fixed between Vauxhall and Battersea bridges, having a suitable cesspool, and main culvert, say nine feet in diameter, where it enters the cesspool, gradually lessening till it reaches above Chelsea. The whole of the drainage of this locality would find its way to this engine, and there be lifted and forced through a three-feet pipe, till it reached the second engine between Vauxhall and Westminster bridges. At this situation would be a similar engine, with cesspool, main culverts, and drains running into it,—which engine would lift and force the sewage in this division into an iron pipe of double the capacity, say four feet three inches diameter, which pipe would be connected to the three-feet pipe coming from the No. 1 engine, just above the cesspool of No. 2 engine. Thus a continuous pipe would proceed from engine to engine, to receive the contents from each, and increase in its dimensions in proportion to the quantity of sewage conveyed, until it reached the East India Docks; the capacity of the main culvert for supplying this last engine would be smallest at the extreme east, and gradually enlarge till it reached the cesspool and engine at or near the West India Docks. The pipe from this engine would be of one uniform size, until it reached the place destined to receive the deposit from the north side of the Thames. Care should be taken in the deposit ground that there should be space enough, and easily accessible to water carriage, as large quantities of antiputrescent matter would be required for mixing with the sewage to render it innocuous. The same principle would be adopted on the south side of the river, but fewer engines, and of less power, would be required, in the proportion of say one to six.

This plan is recommended in preference to a tunnel on each side of the river; as by the arrangement of dividing the whole distance into compartments, and having a cesspool to each division, valves may be used for allowing the rain to escape on extraordinary occasions, and flow into the Thames; which could not be well done with a tunnel on the incline.

The main pipe for taking away the sewage from all the engines would not be more than seven feet diameter on the London side, and would answer as perfectly under a pressure of thirty-six feet head, as a tunnel of more than twenty feet diameter, laid in the natural declivity of the ground,—to say nothing of the difficulty of making so large a tunnel in the way it would have to pass. It has also the advantage of letting the present sewers and drains remain, and only arresting their contents just before they reach the river. It possesses also the great advantage of removing to a

distance the noxious matter so justly complained of as being deposited in the Thames, and is capable of being made most valuable, for enriching and improving the agriculture of our country."

The chairman (J. L. Ricardo, Esq.), in calling for the thanks of the meeting for the communications and explanations of Mr. Smith and Mr. Boccius, remarked on the imperative necessity that there was that the three great causes of the cholera of last year should be removed,—imperfect sewage, deficient water-supply, and intramural interment. Government had taken the remedies for these into its own hands—a fact which he thought was to be regretted, as in this country all the greatest works had been, and, in his opinion were likely to be, the result of private enterprise.

Chemical examinations of the waters of some of the mineral springs of Canada, by T. S. Hunt, Chemist and Mineralogist to the Geological Commission of Canada.

In the course of my official duties, it has devolved upon me to examine the various mineral waters of the province, and to submit the more important of them to accurate analyses. The first part of the results of these enquiries have already appeared in the Report of Progress for 1847-8, which was submitted to his Excellency the Governor-General on the 1st of May, 1849, from which I extract the analyses that follow. Some remarks as to the mode of collecting the waters may not be out of place here, as shewing the precautions taken to prevent errors, and to transport the waters unchanged to the place of analysis. Unless otherwise stated, they were always collected by myself from the spring, and put into large glass jars, holding about one hundred pounds; these were nearly filled, and, being carefully stopped, the mouths were secured by a lute, which entirely excluded air, and prevented the escape of gases. For the determination of the gases, the processes directed by Fresenius, in his admirable treatise, were employed: they consist in directly fixing upon the spot the carbonic acid gas by ammonio-chloride of calcium, and the sulphuretted hydrogen by a solution of chloride of arsenic. Carefully measured portions of the water being placed in bottles with these substances, the bottles were tightly sealed, and could thus be preserved until they were brought to the place of analysis.

In stating the composition of the waters, I shall first give the quantity of bases, acids, and radicals, in a thousand parts, and then, in accordance with the general custom, shew how these may be united to form saline combinations; in following this course I have conformed to the general practice of chemists, rather because the results are more intelligible to the unscientific, and, at the same time, more readily compared with those of other analysts, than because the compounds thus calculated can be supposed to represent the real constitution of the water; for, in

the present state of our knowledge, we must, I think, be led to adopt the idea of a partition of bases among the different radicals; so that the bromine in a saline water, instead of being, as it is here represented, in conformity with general custom, combined as a bromide of magnesium, is divided between the four metals usually present, in proportions which we have not yet the means of determining.

The analyses were performed upon weighed portions of water, in preference to using measures; and the weights, including the specific gravities, were determined by a delicate balance made to order by Deleuil, of Paris, and sensible to the demi-milligramme, when loaded with two hundred grammes.

The Caledonia Springs.—These springs, which are well known as a place of resort during the warm season, are situated a few miles south of the Ottawa River, about forty miles from Montreal. The fountains, which are four in number, rise through strata of post-pliocene clay, which overlie a rock equivalent to the Trenton limestone. Three of them, known as the Gas Spring, the Saline Spring, and the White Sulphur Spring, are situated within a distance of four or five rods, and the mouths of the latter two are not more than four feet apart. The fourth, known as the Intermitting Spring, is situated about two miles distant, and is much more saline than the others. The first three are alkaline, the sulphur spring strongly so, while the fourth contains in solution a great quantity of earthy chlorides.

None of these waters are what are called "acidulous saline," a character which is due to the presence of large quantities of carbonic acid,—the quantity of this acid found being in no case more than is required to form bicarbonates with the bases present.

I. *The Gas Spring.*—The waters of this spring were collected on the 27th of September, 1847. The temperature of the air being 61·7° Fahrenheit, that of the spring was 44·4. The discharge was ascertained, by careful measurement, to be four gallons per minute,—a quantity which is little subject to variation. The water in the well is kept in constant agitation by the escape of carburetted hydrogen gas, which is evolved in considerable quantity. It was roughly estimated at the time to be three hundred cubic inches a minute; but the discharge, as I was informed, is often much more abundant.

The specific gravity of the water was found to be 1006·2. It is pleasantly saline to the taste, but not at all bitter; by exposure to the air it gradually deposits a white sediment of earthy carbonates. Its reaction is distinctly alkaline to test papers.

The examination of the unconcentrated water shewed the presence of chlorine, calcium, and magnesium; but when the liquid is concentrated by boiling, these bases are wholly precipitated as carbonates, and the clear liquid is alkaline, yielding, with a solution of chloride of barium, a copious precipitate of car-

bonate, which is dissolved by hydrochloric acid, leaving only a small quantity of sulphate of baryta. The alkaline liquid being evaporated to dryness, and the residue digested with alcohol, the solution gave evidence of the presence of both bromine and iodine. The saline residue was found to consist of salts of sodium with a small portion of chloride of potassium. The precipitate of earthy carbonates contained traces of alumina, iron, and manganese. On evaporating to dryness a quantity of the water with an acid, and treating the residue with water, a portion of silica was obtained.

The modes by which the quantities of chlorine, sulphuric acid, calcium, magnesium, sodium, and potassium were obtained, need no particular description. The sketch of the plan of analyses here given will be sufficient to show the processes adopted throughout the research; except that where the waters contained chlorides of calcium and magnesium, the amount of these bases was determined first upon one thousand grammes of the water evaporated with an acid; and then the same quantity having been boiled with the addition of distilled water, until all the earthy salts were precipitated, the respective amounts of the calcium and magnesium, both in the precipitate and filtrate, were determined, and those in the latter, regarded as corresponding to the chlorides and sulphates of those bases, in the recent water. The alkalies were separated by successive treatment with baryta and carbonate of ammonia, and the amount of potassium in the mixed chlorides was then determined by converting them into the platino-chlorides, and separating the sodium salt by alcohol.

The bromine and iodine were determined by evaporating fifty pounds of the water to a small bulk, separating the earthy precipitate, and finally evaporating the residue to dryness. This was treated with alcohol of sp. gr. ·835, until all traces of iodides and bromides were removed. The alcoholic solution was then evaporated to dryness, and the treatment removed with alcohol of ·820; this process was repeated a third time, having previously ignited the residue to destroy any organic matters; and the solution being again evaporated to dryness, was dissolved in water, and the amount of iodine determined after the admirable method of Lassaigne, which consists in precipitating it as an iodide of palladium.

The bromides and chlorides remaining in the solution were decomposed by a solution of nitrate of silver; and the mixed precipitate of chloride and bromide of silver, after being fused and carefully weighed, was submitted in a state of fusion to the action of a current of dry chlorine gas, until the whole was converted into chloride;—from the loss, the amount of bromine was deduced by calculation.

The total amount of carbonic acid was determined by mixing measured portions of the water at the source with caustic ammonia and a solution of chloride of calcium;—the proportion of

carbonic acid in the precipitate thus obtained, was determined in the usual manner. The amount of carbonic acid required by those bases which were known to exist as carbonates in the water was then deducted. The quantity of carbonate of soda was calculated from the excess of sodium over that required for the saturation of the chlorine, bromine, iodine, and sulphuric acid, controlled by the amount of carbonate of baryta obtained by treating a solution of the solid residue of 1000 grammes of the water with chloride of barium;—the two results closely agreeing.

1000 parts of the water of the Gas Spring gave—

Chlorine	4·242810
Bromine	·011730
Iodine	·000461
Sulphuric acid (SO^3)	·002400
Soda	3·726400
Potash	·022100
Lime	·082880
Magnesia	·254600
Alumina	·004400
Silica	·031000
Iron and manganese,	traces
Carbonic acid	·705000

These may be combined to form the following compounds:—

Chloride of sodium	6·967500
,, of potassium	·030940
Bromide of sodium	·015077
Iodide of sodium	·000530
Sulphate of potash	·005280
Carbonate of soda	·048570
,, of lime	·148000
,, of magnesia	·526200
of iron and manganese,	traces
Alumina	·004400
Silica	·031000
Carbonic acid	·349000
Water	991·873503
	1000·000000

Saline ingredients in 1000 parts, 7·7775.

Carbonic acid in 100 cubic inches, 17·5.

II. *The Saline Spring.*—The spring thus named is very similar to the last, but, in reality, less strongly saline. Its temperature was 45° F., that of the air being at the same time 60° F. The specific gravity 1005·824. Its reaction is more strongly alkaline; but otherwise the results of its qualitative examination are similar to those given under the head of the "gas spring." It contains no sulphuretted hydrogen whatever. Some few bubbles of carburetted hydrogen are evolved, but the quantity is very small. The discharge from this spring is about ten gallons per minute.

1000 parts of the water gave—

Chlorine	3·93830
Bromine	·01317
Iodine	·00123
Sulphuric acid (SO^3)	·00220
Soda	3.52246
Potash	·04100
Lime	·06580
Magnesia	·25020
Silica	·04250
Alumina, iron, and manganese, traces	
Carbonic acid	·64800

These may be combined in the following manner:—

Chloride of sodium	6·44090
„ of potassium	·02960
Bromide of sodium	·01696
Iodide of sodium	·00146
Sulphate of potash	·00480
Carbonate of soda	·17620
" of lime	·11750
" of magnesia	·51724
Carbonate of iron and manganese } Alumina }	traces
Silica	·04250
Carbonic acid	·29200
Water	992·36084
	1000·00000

The amount of solid matter in 1000 parts of the water is, by calculation, 7·347;—experiment gave 7·280, which is a close approximation. The carbonate of magnesia loses a part of its carbonic acid during the evaporation, and exists in the residue as a basic carbonate; hence the slight deficiency in the result of experiment.

The quantity of carbonic acid, above what is represented as combined with the bases, equals 14·7 cubic inches in 100 cubic inches of the water.

III. *The Sulphur Spring.*—This spring is situated very near to the last;—the openings of the two wells being not more than four feet apart. Although it bears the name of a sulphur water, its claim to that title is very small. It has feebly a sulphurous taste and odor, and darkens slightly salts of lead and silver; but the quantity of sulphur existing either as sulphuretted hydrogen, or as alkaline sulphuret, is very inconsiderable, and cannot be quantitatively estimated by the ordinary processes.

Several bottles of the water were mixed with a solution of arsenic at the spring, but the precipitate of sulphuret of arsenic was scarcely perceptible; the quantity of the sulphuretted hydrogen was not equal to a cubic inch to a gallon. It is still,

however, sufficient to impart medicinal powers to the water; for the efficacy of this spring over all the others in rheumatic and cutaneous affections is well attested. According to Dr. Stirling, who has been for many years a resident at the springs, and is a careful observer, the water was formerly much more sulphurous than at present; a thing not at all improbable, as it is well known that springs often change their character materially in the course of a few years.

The supply from this spring is apparently about the same as that of the "gas spring;" its waters flow into the same reservoir as those of the saline springs, and the two are used for hot baths. The mixture, after being heated for use, is without any odour of sulphur.

The temperature of the spring was found to be 46° F., that of the air being 60° F. The specific gravity of the water at 60 F. is 1003·7; its reaction is strongly alkaline; and the results of its qualitative examination shew that it closely resembled the two preceding waters, except that only traces of iodine were detected in it.

1000 parts of the water of the sulphur spring gave—

Chlorine	2·12500
Bromine	·00781
Iodine	traces
Sulphuric acid	·01030
Potash	·01450
Soda	2·12370
Lime	·11760
Magnesia	·14230
Iron	traces
Alumina	·00265
Silica	·08400
Carbonic acid	·59000

These, combined in the usual manner, give, as the composition of 1000 parts of the water—

Chloride of sodium	3·84300
,, of potassium	·02300
Bromide of sodium	·01004
Iodide of sodium	traces
Sulphate of soda	·01833
Carbonate of soda	·45580
,, of lime	·21000
,, of magnesia	·29400
,, of iron	traces
Alumina	·00265
Silica	·08400
Carbonic acid	·14100
Water	994·91818
	1000·00000

The amount of solid matters in 1000 parts of the water is 4·9406.

The quantity of carbonic acid, over that required to form neutral carbonates, would, in a gaseous state, equal 7·2 cubic inches in 100 of the water. The amount required to form the above carbonates is ·449, and an equal quantity of carbonic acid would be necessary to enable them to exist as bicarbonates—a condition in which these earthy bases are generally regarded as being dissolved in mineral waters. The whole of these alkaline waters have shewn, it will be observed, a deficiency in the quantity of carbonic acid; and this is particularly marked in this last and most strongly alkaline of them all. This apparent difficulty is at once explained by the fact that the whole or a part of the carbonate of magnesia exists in the form of a double carbonate of soda and magnesia—a compound which is readily soluble in water, and much more permanent than the bicarbonate.

The large amount of silica which it contains is an interesting peculiarity, and naturally connects itself with the strongly alkaline character of the water. As silica is capable of decomposing a solution of carbonate of soda, it is probable that a portion of the soda must really exist in the condition of a silicate. From the uncertainty which still remains as to the composition of these soluble silicates, it is impossible to calculate the portion of the soda which should be deducted from that represented as existing as carbonate; but an indirect experiment throws some light upon the question. One thousand grammes of the water were evaporated to perfect dryness, to render all the magnesia insoluble. The residue being then dissolved in distilled water, was mixed with a solution of chloride of barium, and yielded a precipitate of carbonate, with a little sulphate, which contained an amount of carbonic acid corresponding to ·2540 of carbonate of soda, while the excess of soda above that required for saturating the chlorine, bromine, and sulphuric acid, equalled ·4558 parts of carbonate. The difference, ·2018, corresponds to ·1179 of pure soda, which may be regarded as forming a silicate with the ·0840 of silica. With our imperfect knowledge of silicates, especially the soluble ones, it is obviously useless to speculate farther upon the mode of combination in which these substances exist.

IV. *The Intermitting Spring.*—This spring has been already described, as situated about two miles distant from the others. It rises out of a bank of clay near the edge of a brook. A well has been sunk nearly thirty feet through the clay, and the water rises near to the surface. It is kept in almost constant agitation by the evolution of large quantities of carburetted hydrogen gas; the water, from this cause, is kept constantly turbid, by the quantity of clay diffused through it; and it is only after being allowed to stand for several hours, in a quiet place, that it becomes transparent. The discharge of gas is not regular, some minutes often elapsing, during which only a few bubbles escape from time to

time; after which a copious evolution occurs for a few moments, followed by another period of quiescence. From this peculiarity it is named the intermitting spring.

The temperature was found to be 50° F. at the bottom of the well; that of the air being 61°. The amount of water furnished by the spring could not be easily determined, as part of it escapes through the bank, but it is not large. At the time of my visit, the recent rains had diluted the spring with a good deal of surface water, and I accordingly availed myself of the politeness of the proprietor, Mr. Wilkinson, who allowed me to take as much as I required, from a supply which had been brought from the spring a month previous, and preserved in well covered puncheons.

This was sensibly stronger to the taste than the water at the spring, and, unlike the previously-described waters, was disagreeably bitter, as well as saline. Its specific gravity was 1010·939.

A qualitative examination shewed the presence of chlorine, bromine, and iodine, with potassium, sodium, calcium, and magnesium;—a large portion of the latter two exist in the condition of chlorides. No sulphuric acid was detected, but traces of iron and alumina. Baryta, strontia, fluorine, and phosphates, were sought for; but, with the exception of slight traces of the latter, the results were altogether negative.

One thousand parts of the water of the Intermitting Spring afforded—

Chlorine - - -	8·36979
Bromine - - -	·02059
Iodine - - -	·00187
Potash - - -	·01930
Soda - - -	6·49360
Lime - - -	1·44930
Magnesia - - -	·55467
Alumina and iron	traces
Silica - - - -	·02250

These may be so combined as to give the following composition for 1000 parts of the water—

Chloride of sodium - -	12·250000
,, of potassium - -	·030500
,, of calcium - -	·287050
,, of magnesium - -	1·033840
Bromide of magnesium -	·023840
Iodide of magnesium - -	·002057
Carbonate of lime - -	·126460
,, of magnesia - -	·863230
,, of iron -	traces
Alumina -	traces
Silica - - -	·022500
Carbonic acid - - -	·501350
Water - -	984·859173
	1000·000000

The solid matter in 1000 parts, as determined by calculation, is 14·639 parts; the result obtained by directly evaporating a weighed quantity, and drying the residue at 300° F., was 14·500,—the difference being probably due to a partial decomposition of the magnesian chloride during the evaporation.

The carbonic acid of this water was not determined, as the fresh water, which was required for this purpose, was so much diluted as to be unlike the specimen analysed.

In a subsequent paper, I purpose to describe some of the saline springs of the valley of the lower St. Lawrence, which are generally saline, and contain a greater or less proportion of earthy chlorides. The history of the mineral springs of the province, when complete, will present some interesting relations to the geological structure of the country and the nature of the strata from which they rise.—[*Silliman's Amer. Jour. for March*, 1850.]

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

May 29. *William Wright*, of Kilworth, in the county of Cork, Ireland, millwright, for an improved millstone, furrows, and feeder.

29. *Allan Livingston & Son*, of Abercorn Works, Portobello, near Edinburgh, for a hermetical cradle, for joining pipes suitable for water-sewerage.

30. *Francis West*, of 92 and 93, Fleet-street, and 41, Strand, mathematical instrument maker, for a radius rule.

30. *William Pope & Son*, of 81, Edgeware-road, engineers, for improved stop-valves, for the admission of hot and cold water for bath and washhouse purposes.

30. *John Roe*, of West Bromwich, for a lock.

31. *John Marvin*, of the London Gas Works, Vauxhall, for a portable smelting apparatus.

31. *John Heather*, of 3, Bedford-court, Covent-garden, for Blackwell's razor-guard.

31. *Emanuel Bailey Mather*, of 33, and 35, Oxford-road, Manchester, coach-builder, for a drag, with moveable body.

31. *Joseph Fenn*, of Newgate-street, London, tool-maker, for a cymameter.

June 3. *William Peter Piggott*, of 523, Oxford-street, for a galvanic belt.

3. *John Hill*, of 2, Jermyn-street, St. James's, and 97, Regent-street, Westminster, Middlesex, for "the choretikopas or portmanteau," on a new construction.

June 4. *William John Normanville*, of the Queen's-road, Regent's-park, for an elastic attachment for the side-chains of railway carriages, waggons, &c.

4. *George Godsell*, of 206, Regent-street, for a "jupon chemise."

5. *George Ingram*, of the West Bank Brick and Tile Works, Portobello, county of Midlothian, Scotland, for an improved socket-joint, for street and other drains.

5. *John Bessell*, of 7, Farringdon-street, London, for "the invisible ventilator."

5. *Robert Calvert, M.D.*, of 34, Camden-street North, Camden New Town, for a self-adjusting brace.

6. *John Rowan & Sons*, of the York-street Foundry, Belfast, for improved factory ventilators.

8. *George Frederick Hipkins*, of Ashted-row, Birmingham, for "the sportsman's companion", combining nipple-wrench, turnscrew, nipple-pricker, wafer-stamp, and corkscrew.

10. *C. A. & T. Ferguson*, of Millwall, Poplar, London, for an improved gun-carriage.

10. *Edwin Greenslade Bradford*, of Teignmouth, in the county of Devon, jeweller, for a fastener for garments.

10. *John Edward Smith*, of Lawrence-lane, Cheapside, London, for a shirt.

10. *Thomas Grubb*, of Dublin, civil engineer, for an improved spindle and bearing for the dashers of revolving dasher churns.

11. *James William Giles*, of 134, Aldersgate-street, City, for a dress-pin.

13. *George Baddeley*, of 521, Oxford-street, naval and military boot-maker, for a boot.

13. *William Pilbeam*, of Acton-street, Gray's Inn-road, builder, for a smoke-preventing chimney-pot.

14. *Richard Robinson*, of the Eliza-street Works, Belfast, for a compound bar-furnace.

14. *Charles Burton*, of Trowbridge, for an elastic mauler for a weaver's harness.

17. *William Bird*, of 86, Oxford-street, London, for a boot.

17. *Frederick & Charles Huxham*, and *James Armitage Brown*, of Exeter, iron-founders, for driving motion for hand-mills.

17. *Ann Remington*, of 11, Shaftesbury-crescent, Pimlico, for a self-acting baster and vertical heat reflector, for roasting.

17. *Tayler, Henry, & Co.*, of 10, White Lion-street, Spital-square, for an imperial disinfecting filter.

20. *Philip le Capelain the Elder*, of Long Acre, for a portable oven.

June 21. *Joseph Lester*, of 1, Great Cambridge-street, Hackney-road, parish of St. Leonard's, Shorditch, for a filtering funnel.

21. *Henry B. Hewett*, of 308, High Holborn, and 45, Ludgate-hill, for "the Chaud Froid."

22. *Samuel & Frederick Hattersley*, of Westbroook Works, Bradford, for a shaping-plate for forming the cop or spool in spinning yarns.

24. *John Goulding, John George Goulding, and Alfred Goulding*, of 1 and 2, Eldon-street, Finsbury, office furniture-makers, for "the omnium office table."

25. *Abraham Anguste Neuburger*, of 4, South-street, Finsbury, London, for an improved night-lamp boiler.

25. *Thomas Dowler*, of Birmingham, for a match box.

26. *Thomas Ryan Pinches*, of Oxendon-street, Haymarket, London, for a purse envelope.

26. *Leonard Hicks*, of Leeds, for "the cape coat."

26. *John Sellers*, of Sheffield, for a razor.

26. *Stephen Sharp*, of Stamford, artist, for a lump-sugar cutting machine.

26. *Webb and Greenway*, of Birmingham, for a cupboard fastener.

27. *Jomes and George Johnston*, of Paisley, manufacturers, for cutting apparatus for bonnet tops.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th May to the 17th June, 1850, inclusive.

To John Stevenson, of Roan Mills, Dungannon, county Tyrone, flax-spinner, for certain improvements in machinery for spinning flax and other substances.—Sealed 25th May.

List of Patents

Granted for SCOTLAND, subsequent to May 22nd, 1850.

To George Jackson, of Belfast, flax-dresser, for improvements in heckling machinery.—Sealed 24th May.

Frederick Rosenborg, of Albemarle-street, London, and Conrad Montgomery, of the Army and Navy Club, St. James's-square, London, for improvements in sawing, cutting, boring, and shaping wood.—Sealed 24th May,

George Haywood Ford, of St. Martin's-le-Grand, London, for improvements in obtaining power,—being a communication.—Sealed 27th May.

Joseph Barrons, of St. Paul's, Deptford, engineer, for improvements in axles and axle-boxes of locomotive engines and other railway carriages.—Sealed 27th May.

Samuel Fisher, of Birmingham, engineer, for improvements in railway carriage-wheels, axles, buffer and draw-springs, and hinges for railway carriage and other doors.—Sealed 28th May.

Thomas Chandler, of Stockton, Wilts, for improvements in machinery for applying liquid manure.—Sealed 28th May.

Thomas Dickson Rotch, of Drumlamford House, Ayrshire, for improvements in separating various matters usually found combined in certain saccharine, saline, and ligneous substances, —being a communication.—Sealed 28th May.

Henry Columbus Hurry, of Manchester, civil engineer, for certain improvements in the method of lubricating machinery.—Sealed 29th May.

Simon Pincoffs, of Manchester, merchant, for certain improvements in the ageing process in printing and dyeing calicoes and other woven fabrics; which improvements are also applicable to other processes in printing and dyeing calicoes and other woven fabrics,—being partly a communication.—Sealed 30th May.

James Palmer Budd, of the Ystalyfera Iron Works, Swansea, merchant, for improvements in the manufacture of coke.—Sealed 31st May.

Charles Andrew, of Compstall-bridge, in the county of Chester, manufacturer, and Richard Markland, of the same place, manager, for certain improvements in the method of, and in the machinery or apparatus for, preparing warps for weaving.—Sealed 31st May.

William Macalpine, of Spring Vale, Hammersmith, London, general dresser, and Thomas Macalpine, of the same place, manager, for improvements in machinery for washing cotton, linen, and other fabrics.—Sealed 31st May.

John Dalton, of Hollingworth, in the county of Chester, calico printer, for certain improvements in, and applicable to, machinery or apparatus for bleaching, dyeing, printing, and finishing textile and other fabrics, and in the engraving copper rollers and other metallic bodies.—Sealed 5th June.

Frederick Albert Gatty, of Accrington, in the county of Lancaster, manufacturing chemist, for a certain process or certain processes for obtaining carbonate of soda and carbonate of potash. —Sealed 5th June.

Jules le Bactier, of Paris, now of South-street, Finsbury, for cer-

tain improvements in machinery or apparatus for printing.—Sealed 6th June.

William Robertson, of Gateside Mill, Neilston, Renfrewshire, for improvements in certain machinery used for spinning and doubling cotton and other fibrous substances.—Sealed 7th June.

Francis Tongue Rufford, of Prescott House, in the county of Worcester, fire-brick manufacturer; Isaac Marson, of Crudley, in the same county, potter; and John Finch, of Pickard-street, City-road, London, manufacturer, for improvements in the manufacture of baths and wash-tubs or wash-vessels.—Sealed 10th June.

Baron Louis lo Presti, of Paris, for improvements in hydraulic presses, which are in whole or in part applicable to pumps and other like machines.—Sealed 10th June.

Charles Cowper, of Southampton-buildings, Chancery-lane, London, patent agent, for improvements in instruments for measuring, indicating, and regulating the pressure of air, steam, and other fluids; and in instruments for measuring, indicating, and regulating the temperature of the same; and in instruments for obtaining motive power for the same,—being a communication.—Sealed 14th June.

Arthur Elliott, of Manchester, machine-maker, and Henry Keys, of the same place, book-keeper, for certain improvements in machinery for manufacturing woven fabrics.—Sealed 14th June.

William Watson, the younger, of Chapel Allerton, in the parish of Leeds, Yorkshire, for improvements in the preparation and manufacture of various materials to be used in the processes of dyeing, printing, and coloring.—Sealed 18th June.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, civil engineer, for improvements in rotatory engines,—being a communication.—Sealed 21st June.

James Ward Hoby, of Blackheath, London, engineer, for certain improvements in the construction of parts of the permanent way of railways, and in shaping iron.—Sealed 21st June.

New Patents
SEALED IN ENGLAND.
1850.

To James Ashworth, of Rochdale, in the county of Lancaster, woollen manufacturer, and Thomas Mitchell, of the same place, manager, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, wool, and other fibrous materials. Sealed 29th May—6 months for inrolment.

Jonathan Harlow, of Birmingham, for improvements in the manufacture of bedsteads, and other articles, for sitting or reclining on. Sealed 30th May—6 months for inrolment.

Edwyn John Jeffery Dixon, of the Royal Slate Quarries, Brynhafod, near Bangor, North Wales, for improvements in the manufacture of sinks and other articles of slate or stone. Sealed 30th May—6 months for inrolment.

Thomas Page, of Middle Scotland-yard, in the county of Middlesex, civil engineer, for improvements in the construction and means of cleansing sewers. Sealed 1st June—6 months for inrolment.

Ezra Jenks Coates, of Bread-street, Cheapside, merchant, for improvements in the manufacture of bolts, spikes, and nails. Sealed 1st June—6 months for inrolment.

Moses Poole, of the Patent Bill Office, London, Gent., for improvements in machinery for punching metals, and in the construction of springs for carriages, and other uses. Sealed 1st June—6 months for inrolment.

Arthur Elliott, of Manchester, machine-maker, and Henry Heys, of the same place, book-keeper, for certain improvements in machinery for manufacturing woven fabrics. Sealed 1st June—6 months for inrolment.

Guillaume Ferdinand de Douhet, of Clermont Ferrand, in the Republic of France, Gent., for improvements in the disoxygenation of certain bodies, and the application separately, or simultaneously, of the products therefrom to various useful purposes. Sealed 1st June—6 months for inrolment.

Frank Clarke Hills and George Hills, of Deptford, manufacturing chemists, for certain improvements in manufacturing and refining sugar. Sealed 1st June—6 months for inrolment.

Samuel Brown, of Lambeth, in the county of Surrey, engineer, for improvements in engines for measuring and registering the flow of fluids and substances in a fluid state,—which improvements are also applicable to steam and other motive engines. Sealed 1st June—6 months for inrolment.

John Tucker, of the Royal Dockyard, Woolwich, shipwright, for improvements in steam-boilers, and in gearing, cleansing, and propelling vessels,—being a communication. Sealed 1st June—6 months for inrolment.

George Hayward Ford, of Saint Martin's-le-Grand, in the county of Middlesex, Gent., for improvements in obtaining power,—being a communication. Sealed 3rd June—6 months for inrolment.

Paul de Angely, of Paris, Gent., for certain improvements in the construction of privies and urinals, and in apparatus and machinery for cleansing privies, cesspools, and other places, and in deodorizing the matter extracted therefrom, and rendering it available for agricultural purposes. Sealed 4th June—6 months for inrolment.

David Napier and James Murdock Napier, of the York-road, Lambeth, in the county of Surrey, engineers, for improvements in apparatus for separating fluid from other matters. Sealed 4th June—6 months for inrolment.

Theodore Cartali, of Manchester, merchant, for certain improvements in the treatment or preparation of yarns or threads for weaving,—being a communication. Sealed 4th June—6 months for inrolment.

William Watson, the younger, of Chapel Allerton, in the parish of Leeds, and county of York, manufacturing chemist, for improvements in the preparation and manufacture of various materials to be used in the processes of dyeing, printing, and colouring. Sealed 4th June—6 months for inrolment.

John Sykes and Adam Ogden, both of Dock-street, Huddersfield, in the county of York, wool-cleaners and machine-makers, for certain improvements in machinery for cleaning wool, cotton, and similar fibrous substances, from burrs, motes, and other extraneous matter. Sealed 4th June—6 months for inrolment.

Edmund Sharpe, of Lancaster, Master of Arts, for certain improvements in railway carriages. Sealed 5th June—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements applicable to boots, shoes, and other coverings for, or appliances to, the feet,—being a communication. Sealed 6th June—6 months for inrolment.

George Jackson, of Belfast, Ireland, flax-spinner, for improvements in heckling machinery. Sealed 6th June—6 months for inrolment.

John Mc Nicol, of Liverpool, engineer, for improvements in machinery for raising and conveying weights. Sealed 6th June—6 months for inrolment.

William Robertson, of Gateside-mill, Neilston, in the county of Renfrew, Scotland, machine-maker, for improvements in certain machinery used for spinning and doubling cotton and other fibrous substances. Sealed 6th June—6 months for inrolment.

James Alexander Hamilton Bell, of the City of New York, in the United States of America, merchant, for improvements in dressing bran, pollard, and sharps,—being a communication. Sealed 6th June—6 months for inrolment.

William George Bicknell, of Essex-street, Strand, and James Reginald Torin Graham, of the Grove, Clapham-common, for an extension for the term of six years of letters patent, granted by His late Majesty King William the Fourth, to Miles Berry, of Chancery-lane, patent agent, for an invention of certain improvements in machinery or apparatus for cleaning, purifying, and drying wheat, or other grain or seeds. Sealed 7th June.

William Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for certain improvements in the manufacture of cords, ropes, bands, strong cloths, quilting, sacks, and cushions, and in elastic material for stuffing the latter,—in which manufacture, caoutchouc forms an essential ingredient; and in the application of parts of these improvements to the manufacture of pads, stoppers, tubes, boxes, baskets, coverings, wrappers, and other like articles of utility,—being a communication. Sealed 8th June—6 months for inrolment.

James Colman, of Stoke Mills, Stoke, near Norwich, in the county of Norfolk, mustard and starch manufacturer, for improvements in the manufacture of starch. Sealed 8th June—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in oscillating engines, put in motion by steam and gas resulting from combustion,—being a communication. Sealed 8th June—6 months for inrolment.

Charles Warwick, of Cheapside, warehouseman, for improvements in apparatus for taking up the work of certain descriptions of knitting machinery,—being a communication. Sealed 8th June—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for certain improvements in the manufacture of sulphate of soda, muriatic and nitric acids,—being a communication. Sealed 11th June—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for improvements in machinery for carding cotton, wool, or other fibrous materials; and in apparatus for preparing or setting the cards of carding-engines,—being a communication. Sealed 11th June—6 months for inrolment.

William Jackson, of the Town and Borough of Kingston-upon-Hull, soap-maker, for improvements in the manufacture of soap, and in the preparation of materials to be used for this purpose. Sealed 11th June—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for improvements in rotary engines,—being a communication. Sealed 11th June—6 months for inrolment.

Robert Waddell, of Liverpool, in the county of Lancaster, engineer, for certain improvements in steam-engines. Sealed 11th June—6 months for inrolment.

Alexander Parkes, of Pembrey, Carmarthenshire, experimental chemist, for improvements in smelting and treating certain metals, and in the construction and manufacture of furnaces, and the materials to be used for the same,—such furnaces and materials being applicable to the treatment of metals and metallic compounds, and to various other useful purposes of a like nature. Sealed 11th June—6 months for inrolment.

William Pole, of Great George-street, Westminster, engineer, and David Thomson, of Belgrave-road, Pimlico, engineer, for improvements in steam-engines. Sealed 11th June—6 months for inrolment.

John Henry Vries, of Norfolk-street, Strand, Middlesex, Esq., for improvements in working engines by atmospheric air. Sealed 11th June—6 months for inrolment.

James Palmer Budd, of the Ystalyfera Iron Works, Swansea, merchant, for improvements in the manufacture of coke. Sealed 11th June—6 months for inrolment.

John Dearman Dunnicliff, of Hyson Green, in the county of Nottingham, lace manufacturer, and John Woodhouse Bagley, of Radford, in the said county, lace maker, for certain improvements in lace and other weavings. Sealed 11th June—6 months for inrolment.

Samuel Ellis, of Salford, engineer, for improvements in machinery or apparatus applicable to all kinds of carriages used on railways. Sealed 11th June—6 months for inrolment.

Frederick Albert Gatty, of Accrington, in the country of Lancaster, manufacturing chemist, for a certain process, or certain processes, for obtaining carbonate of soda and carbonate of potash. Sealed 11th June—6 months for inrolment.

William Cox, of the firm of William Cox and Co., of Manchester, cigar merchant, for certain improvements in machinery or apparatus for manufacturing aerated waters, or other such liquids. Sealed 11th June—6 months for inrolment.

John Sidebottom, of Broadbottom, in the county of Chester, manufacturer, for improvements in looms for weaving. Sealed 11th June—6 months for inrolment.

William MacLardy, of Manchester, machinist, for certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials. Sealed 12th June—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the production of gases, to be used for lighting, heating, and motive power purposes,—being a communication. Sealed 12th June—6 months for inrolment.

Gustavus Palmer Harding, of Bartlett's-buildings, in the City of London, artificial florist, for improvements in the manufacture of buttons and other fastenings. Sealed 12th June—6 months for inrolment.

Thomas Deakin, of Balsall Heath, in the county of Worcester, Esq., for certain improvements in machinery and apparatus to be used in rolling metals; and in the manufacture of metal tubes. Sealed 12th June—6 months for inrolment.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels. Sealed 12th June—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, Middlesex, civil engineer, for certain improvements in the construction of railways,—being a communication.—Sealed 12th June—6 months for inrolment.

George Allen Everitt, of the firm of Allen Everitt and Son, of the Kingston metal works, in the borough of Birmingham, metal and tube manufacturers, and George Glydon, of Birmingham aforesaid, engineer, and foreman to the said Allen Everitt and Son, for certain improvements in the manufacture of metal tubes for locomotive, marine, and other boilers. Sealed 12th June—6 months for inrolment.

John Manly, jun., of Birmingham, manufacturer, for certain improvements in the manufacture of nails. Sealed 12th June —6 months for inrolment.

Charles Lamport, of Workington, in the county of Cumberland, ship-builder, for certain improvements in machinery or apparatus for lifting and moving weights, working chains, and pumping; which improvements are more especially adapted for ship use. Sealed 19th June—6 months for inrolment.

Charles Greenway, of Green-street, Grosvenor-square, in the county of Middlesex, for improvements in ships' and other pumps, in anchors, and in propelling vessels. Sealed 19th June—6 months for inrolment.

Benjamin Cheverton, of Camden-street, Camden-town, in the county of Middlesex, artist, for methods of imitating ivory and bone. Sealed 19th June—6 months for inrolment.

Charles Hanson, of Stepney, in the county of Middlesex, engineer, for certain improvements in steam-engines, steam-boilers, and safety-valves, and in apparatus and machinery for propelling vessels. Sealed 19th June—6 months for inrolment.

Isaac Hartas, of Wrelton-hall, in the county of York, farmer, for improvements in machinery for obtaining motive power,—being a communication. Sealed 19th June—6 months for inrolment.

Robert Heath, of Manchester, iron-merchant, and Richard Handley Thomas, of Wolstanton, in the county of Stafford, engineer, for certain improvements in the manufacture of iron. Sealed 19th June—6 months for inrolment.

Ethan Baldwin, of the City of Philadelphia, and state of Pennsylvania, in the United States of America, for a new and useful method of generating and applying steam in propelling vessels, locomotives, and stationary machinery. Sealed 19th June—6 months for inrolment.

Robert Weare, of Angel-court, Throgmorton-street, clock and watch-manufacturer, for certain improvements in the means and apparatus for extinguishing fire, and in galvanic batteries. Sealed 19th June—6 months for inrolment.

George Robarts, of Tavistock, in the county of Devon, Gent., for certain improvements in clogs and pattens. Sealed 19th June —2 months for inrolment.

Gaspard Malo, of Dunkirk, in the Republic of France, ship-owner, for certain improvements in propelling vessels. Sealed 20th June—6 months for inrolment.

William Saunders, of the firm of Randell and Saunders, of Bath, in the county of Somerset, stone-merchants, for improvements in sawing, and sawing-machinery. Sealed 20th June—6 months for inrolment.

John Hunt, of Stratford, in the county of Essex, engineer, for improvements in forming and moulding plastic substances, and the machinery and apparatus employed therein. Sealed 20th June—6 months for inrolment.

Robert Andrew Macfie, of Liverpool, sugar refiner, for improvements in manufacturing, refining, and preparing sugar; also improvements in manufacturing and treating animal charcoal. Sealed 24th June—6 months for inrolment.

Henry Stephens, of Stamford-street, Blackfriars-road, writing-fluid manufacturer, and Edwyn Wylder, of Paddington, mechanist, for certain improvements in ever-pointed pencils, pens, and pen-holders. Sealed 24th June—6 months for inrolment.

William Laird, of Liverpool, merchant, for improvements in life-boats, and in apparatus for filtering and purifying water,—partly a communication. Sealed 24th June—6 months for inrolment.

Joshua Vickerman Binns, of Lockwood, near Huddersfield, in the county of York, mechanic, for improvements in piecing wool-cardings, and in a machine called a piecing-machine. Sealed 24th June—6 months for inrolment.

Edward Mitchell, of Great Sutton-street, Clerkenwell, Gent., for improvements in fastenings for articles used for writing and drawing and other purposes; and improvements in articles to be used for writing and drawing. Sealed 24th June—6 months for inrolment.

John Percy, of Birmingham, Doctor of Medicine, and Henry Wiggin, of the same place, manufacturer, for a new metallic alloy or new metallic alloys. Sealed 24th June—6 months for inrolment.

Thomas Fulljames, of Old Kent-road, Gent., for certain improvements in machinery or apparatus for raising, lowering, and moving weights or other heavy bodies. Sealed 26th June—6 months for inrolment.

James Forster, of Liverpool, merchant, for improvements in filtering water and other liquids. Sealed 27th June—6 months for inrolment.

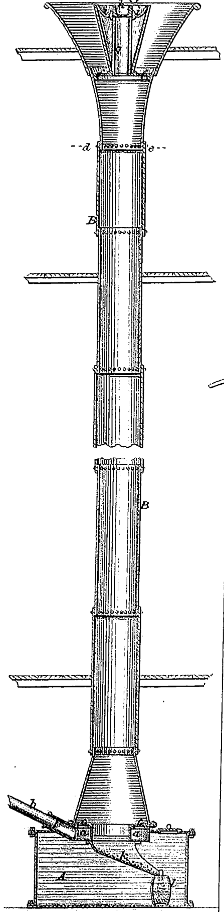
Joseph Foot, of Spital-square, in the county of Middlesex, for improvements in bolters. Sealed 27th June—6 months for inrolment.

CELESTIAL PHENOMENA FOR JULY, 1850.

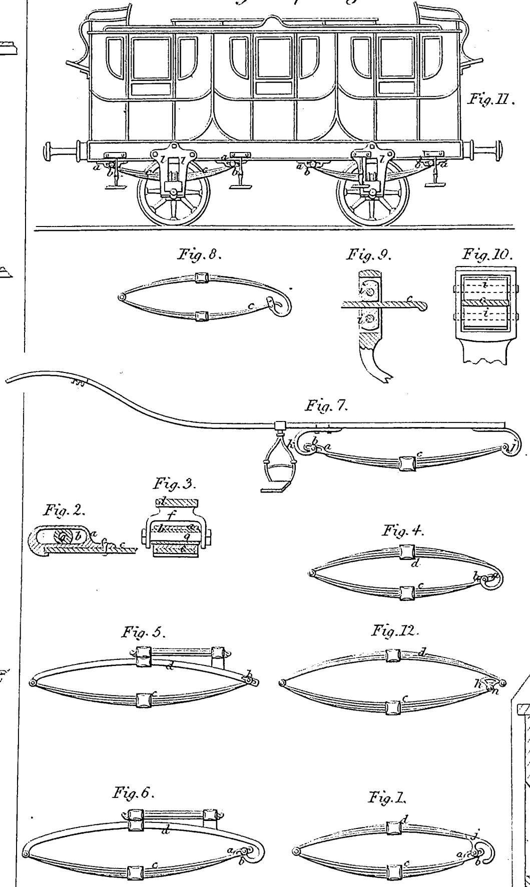
D.	H.	M.	
1			Clock before the ☉ 3m. 23s.
	—		☽ rises 11h. 49m. A.
	—		☽ passes mer. 4h. 57m. M.
	—		☽ sets 10h. 38m. M.
2	5	58	☽ in □ or last quarter
	10	18	♃'s first sat. will em.
	22	39	♄ in conj. with the ☽ diff. of dec. 2. 26. N.
3	9	48	☉ in Apogee
	15	7	♅ in conj. with the ☽ diff. of dec. 4. 45. N.
	17	53	☿ greatest elong, 21. 15. W.
5			Clock before the ☉ 4m. 8s.
	—		☽ rises 1h. 0m. M.
	—		☽ passes mer. 8h. 3m. M.
	—		☽ sets 3h. 19m. A.
	2	24	Juno in □ with ☉
6	8	40	♃'s second sat. will em.
7	15	9	☿ in conj. with the ☽ diff. of dec. 1. 50. N.
9	2	27	Ecliptic conj. or ● new moon
	15	0	☽ in Perigee
10			Clock before the ☉ 4m. 56s.
	—		☽ rises 4h. 59m. M.
	—		☽ passes mer. 1h. 0m. A.
	—		☽ sets 8h. 53m. A.
11	11	25	♀ in conj. with the ☽ diff. of dec. 0. 59. N.
12			Occul. MARS, im. 5h. 28m. em. 6h. 32m.
	5	18	♂ in conj. with the ☽ diff. of dec. 0. 43. S.
	12		♀ in conj. with Vesta, diff. of dec. 2. 48. N.
	23	22	♄ in □ with the ☉
13	4	55	♃ in conj. with the ☽ diff. of dec. 1. 50. S.
15			Clock before the ☉ 5m. 34s.
	—		☽ rises 11h. 29m. M.
	—		☽ passes mer. 5h. 33m. A.
	—		☽ sets 11h. 26m. A.
	—		Occul. 65 Virginis, im. 11h. 15m. em. 11h. 30m.
16			Mercury R. A. 6h. 32m. dec. 22. 53. N.
	—		Venus R. A. 10h. 2m. dec. 13. 43. N.
	—		Mars R. A. 10h. 33m. dec. 10. 8. N.
16			Vesta, R. A., 9h. 52m. dec. 17. 28. N.
	—		Juno, R.A.,13h.8m. dec. 2. 17. N.
	—		Pallas, R. A., 22h. 2m. dec. 12. 53. N.
	—		Ceres R.A. 0h. 49m. dec. 8. 14. S.
	—		Jupiter R. A. 11h. 21m. dec. 5m. 23. N.
	—		Saturn R. A. 1h. 20m. dec. 5. 47. N.
	—		Georg. R. A. 1h. 53m. dec. 11. 1. N.
	—		Mercury passes mer. 23h. 0m.
	—		Venus passes mer. 2h. 26m.
	—		Mars passes mer. 2h. 57m.
	—		Jupiter passes mer. 3h. 45m.
	—		Saturn passes mer. 17h. 41m.
	—		Georg. passes mer. 18h. 14m.
	6	41	☽ in □ or first quarter.
17	17	17	☿ in the ascending node
18	3	36	♃'s first sat. will em.
20			Clock before the ☉ 5m. 59s.
	—		☽ rises 5h. 5m. A.
	—		☽ passes mer. 9h. 30m. A.
	—		☽ sets 1h. 15m. M.
21			Occul. 21 Sagittarii, im. 10h. 22m. em. 11h. 13m.
22	6	51	☿ in Perihelion
23	2	13	♅ in □ with the ☉
	22		☽ in Apogee
24			Occul. 19 Capricorni, im. 9h. 6m. em. 10h. 6m.
	—		Occul. 21 Capricorni, im. 13h. 4m. em. 14h. 20m.
	5	24	Ecliptic oppo. or ○ full moon
25			Clock before the ☉ 6m. 10s.
	—		☽ rises 8h. 41m. A.
	—		☽ passes mer. 0h. 41m. M.
	—		☽ sets 5h. 18m. M.
30	7		♄ in conj. with the ☽ diff. of dec. 2. 26. N.
	22	36	♀ in conj. with ♂ diff. of dec. 0. 15. S.
	23	5	♅ in conj. with the ☽ diff. of dec. 4. 50. N.
31	0	28	☿ in sup. conj. with the ☉
	—		Occul. x^2 Ceti, im. 10h. 51m. em. 11h. 2m.

J. LEWTHWAITE, Rotherhithe.

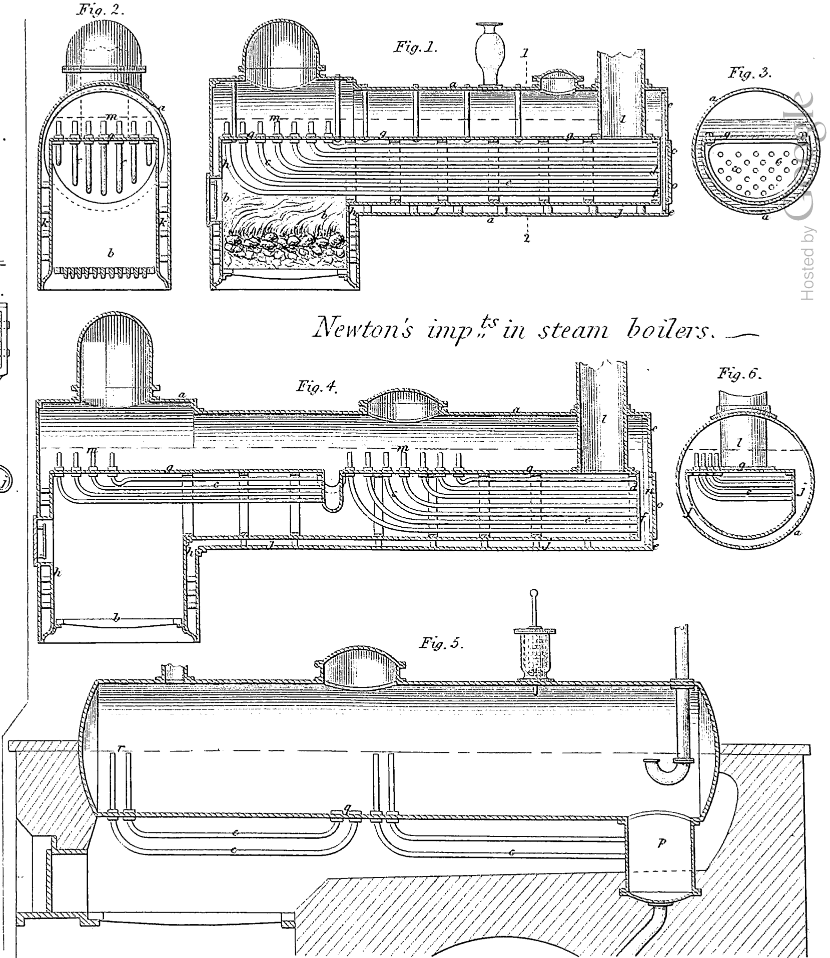
Smith's imp.ts in casting shot.



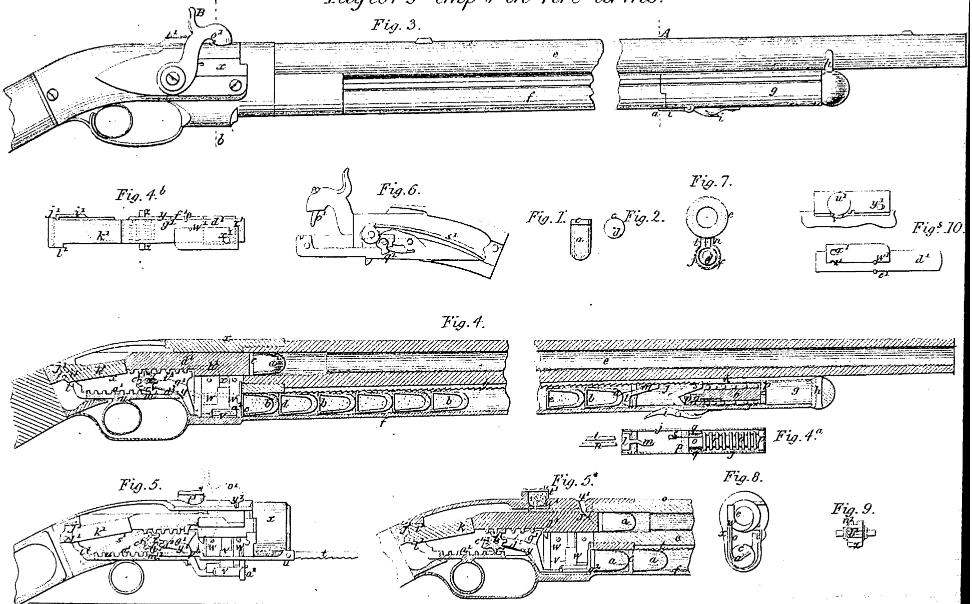
Fuller & Tabernacles imp.d carriage springs.



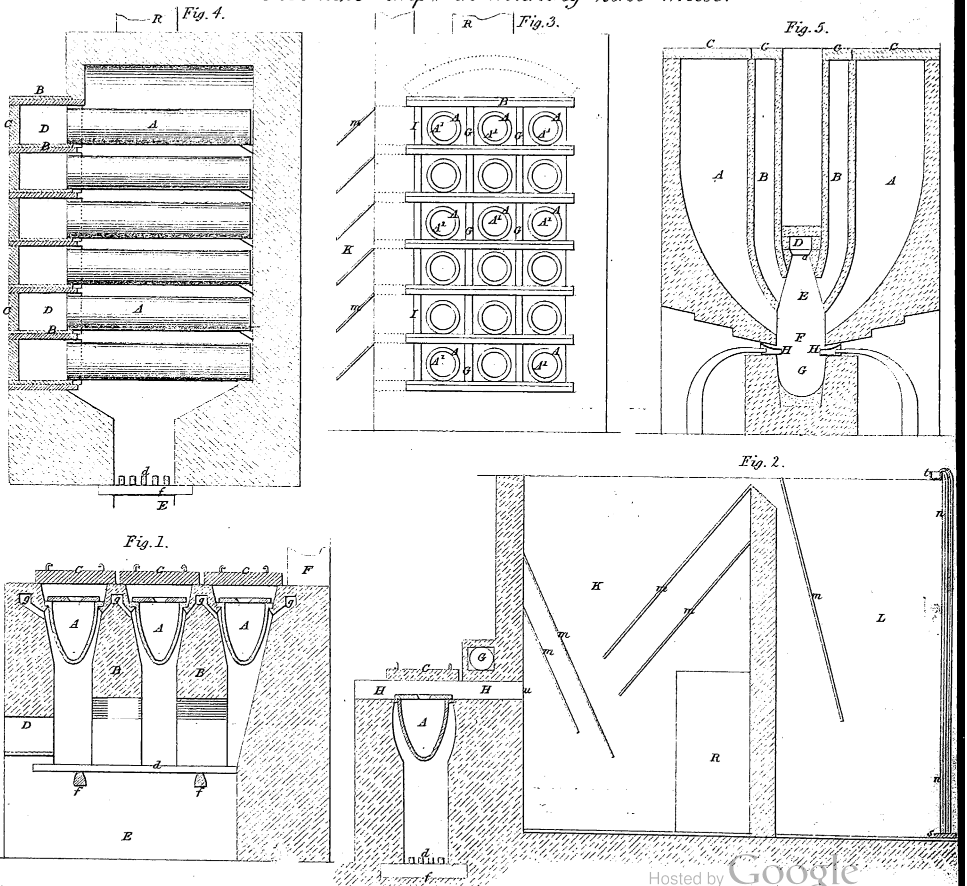
Newton's imp.ts in steam boilers.



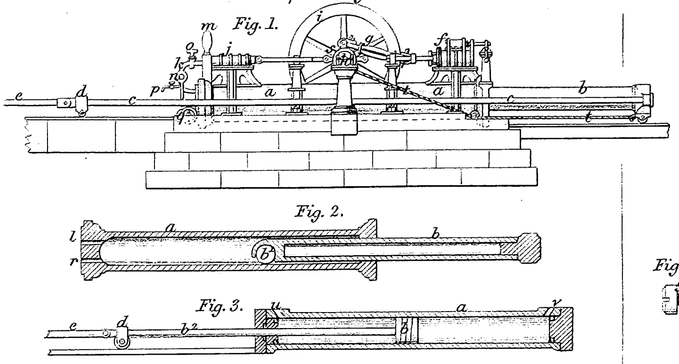
Taylor's imp^{ts}. in fire arms.



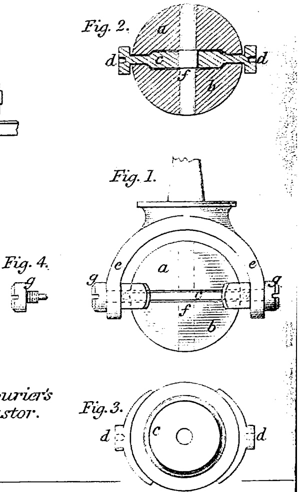
Rochaz's imp^{ts}. in making zinc-white.



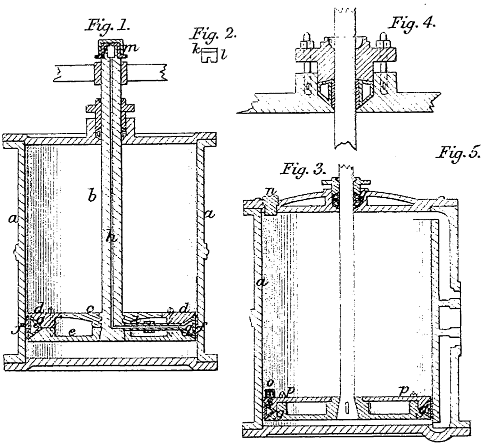
Miller's impts in hydraulic machy.



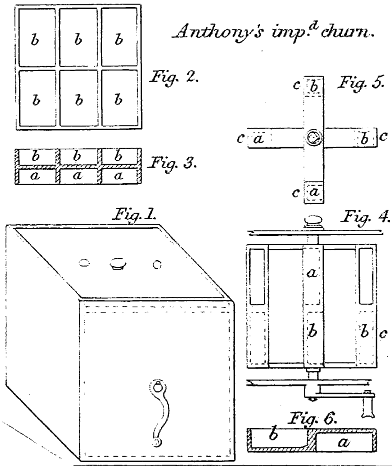
Chauffourier's impd castor.



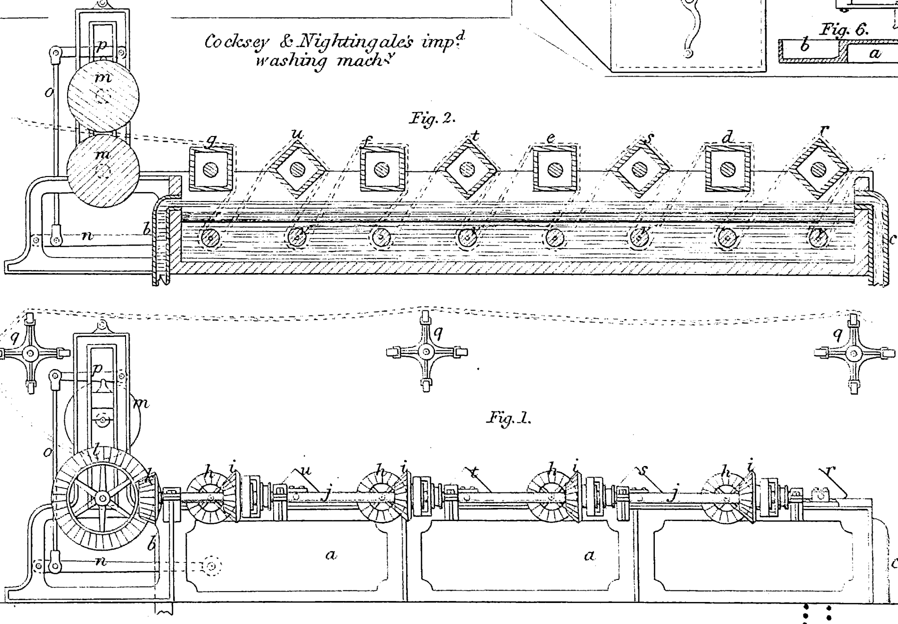
Moat's impts in steam engines.



Anthony's impd churn.

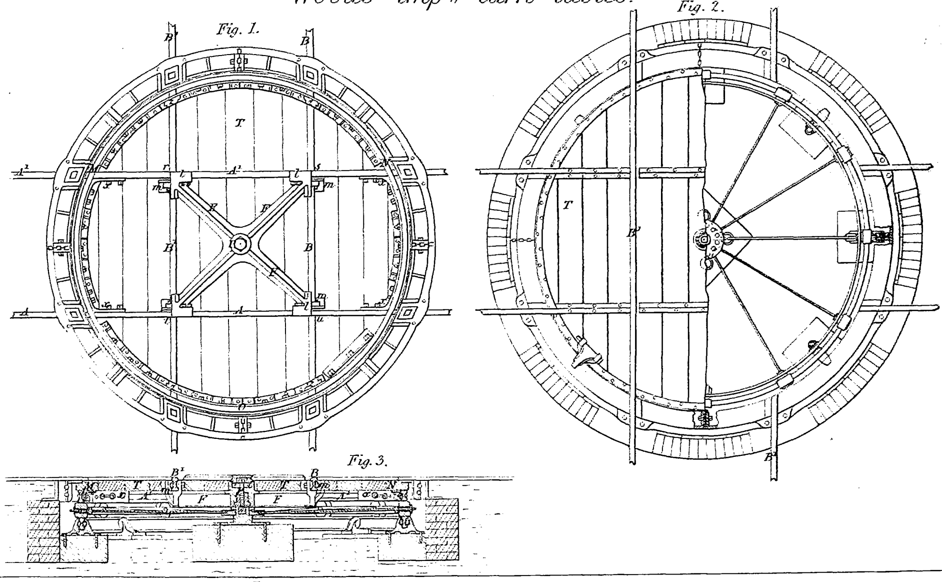


Cocksey & Nightingale's impd washing machy.

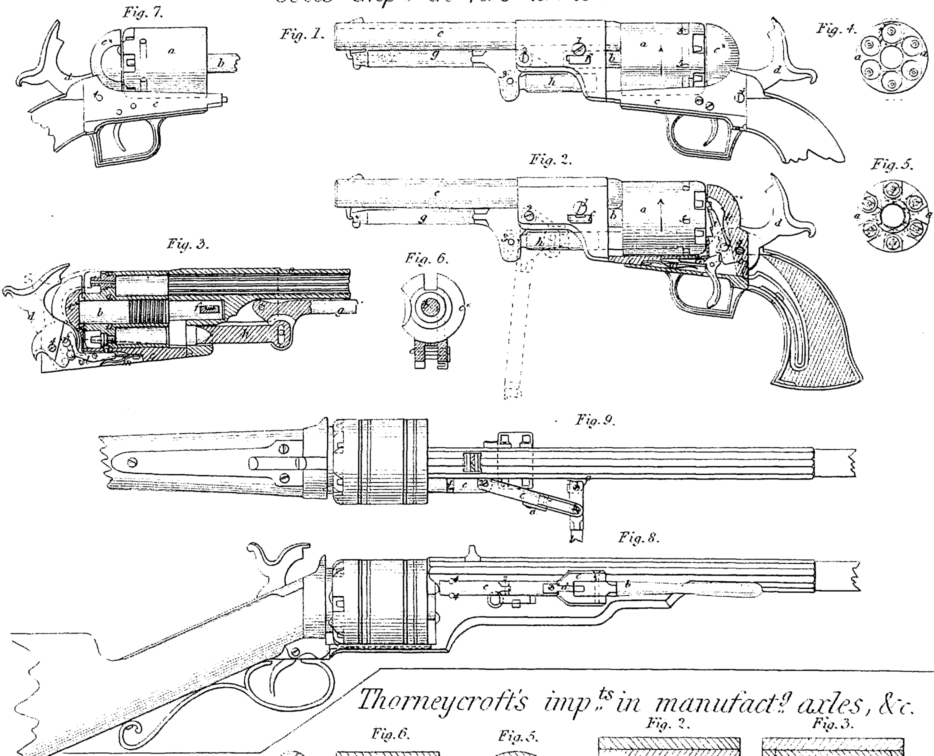


W. Newton, delt 1st February, 1850. Sherratt sc.

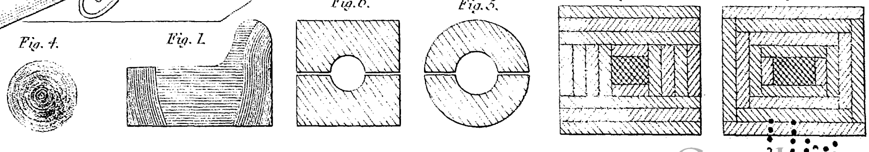
Woods' imp.d turn-tables.



Colt's imp.ts in fire arms.

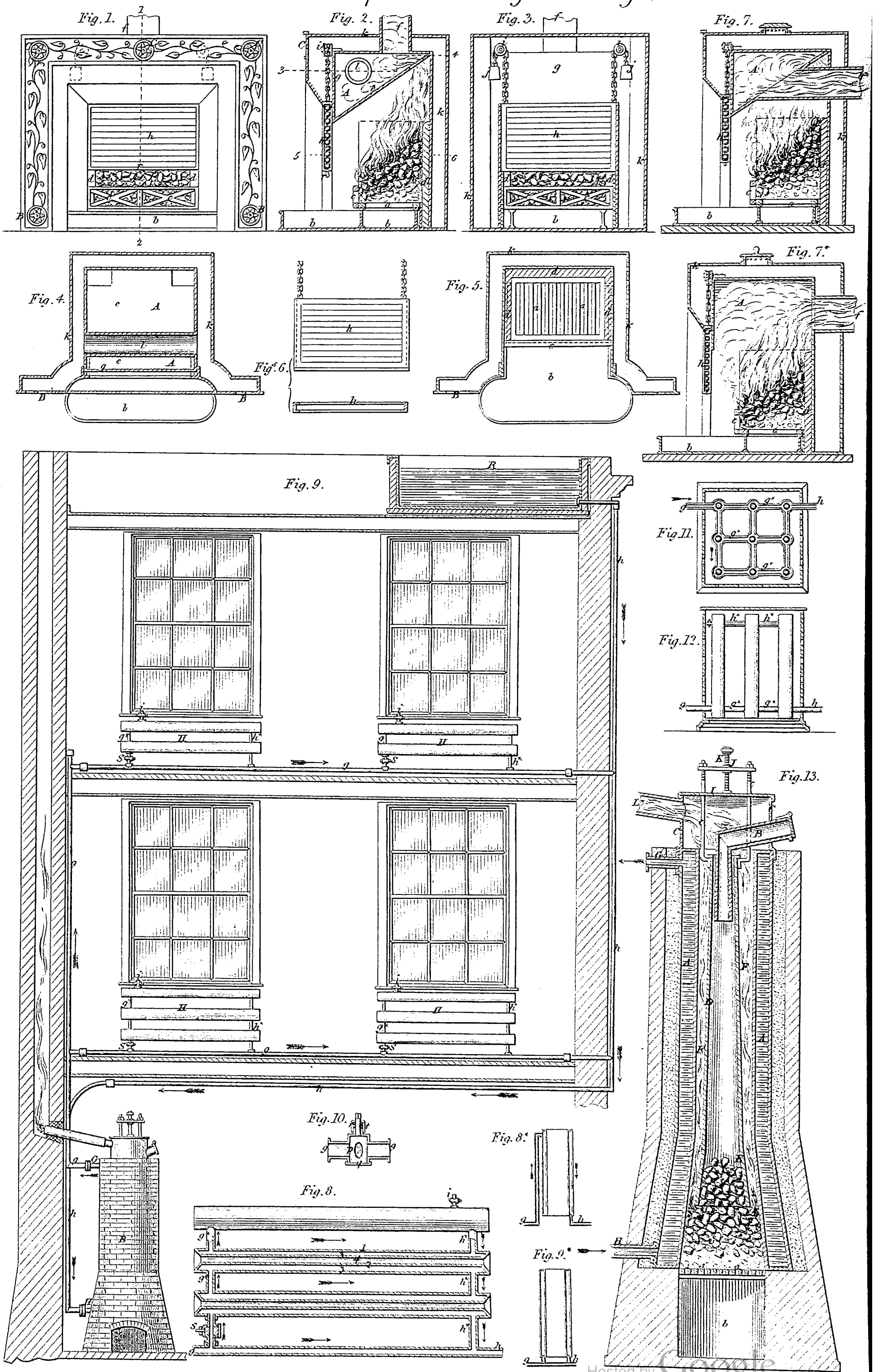


Thorneycroft's imp.ts in manufact.g axles, &c.

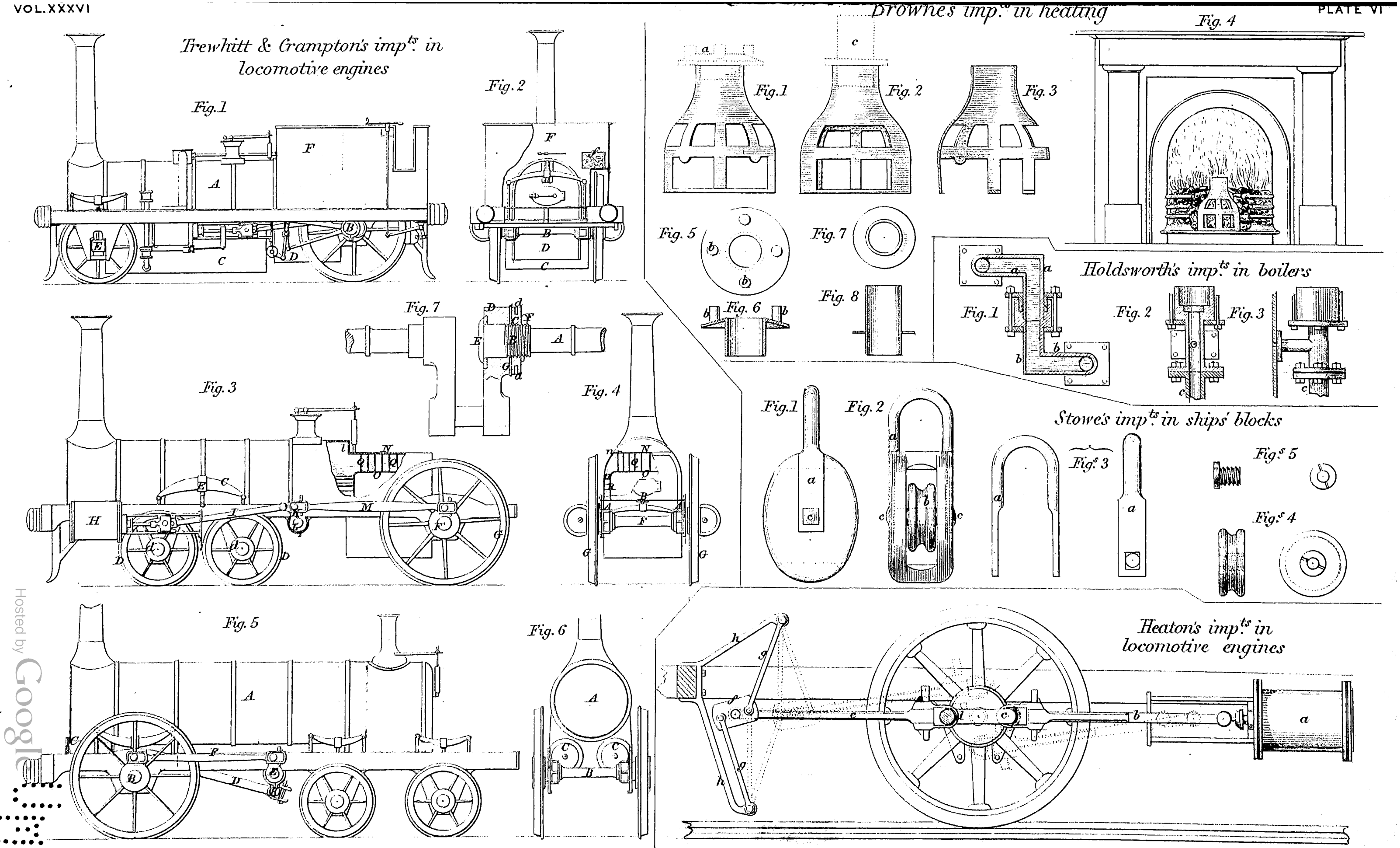


W. Newton del. 1st March 1850. [illegible] sc.

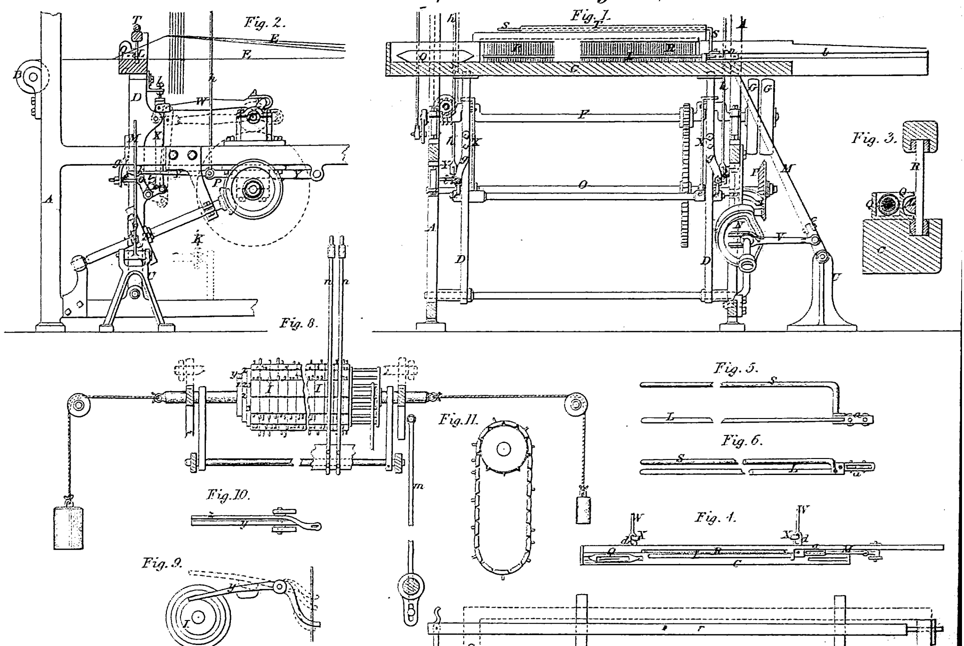
Newton's imp.ts in heating buildings.



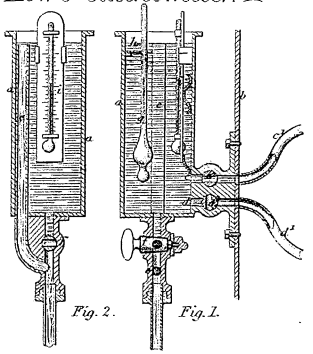
W. Newton del. 1st March 1850. W.A. Beever sc.

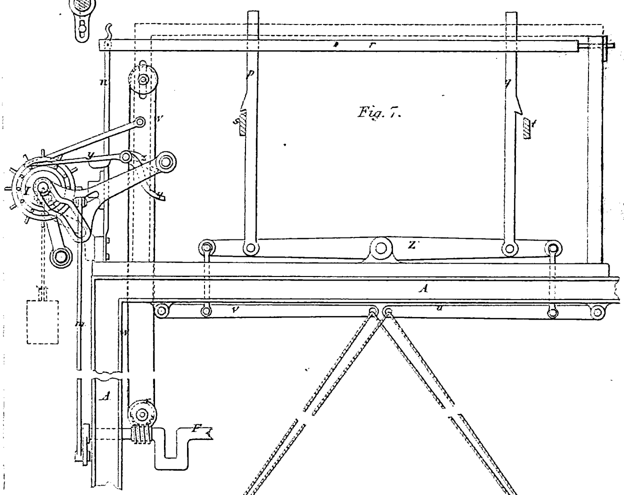

Trewhitt & Grampton's impts. in locomotive engines
Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 5
Fig. 6
Fig. 7
Browne's impts. in heating
Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 5
Fig. 6
Fig. 7
Fig. 8
Holdsworth's impts. in boilers
Fig. 1
Fig. 2
Fig. 3
Stowe's impts. in ships' blocks
Fig. 1
Fig. 2
Figs. 3
Figs. 4
Figs. 5
Heaton's impts. in locomotive engines

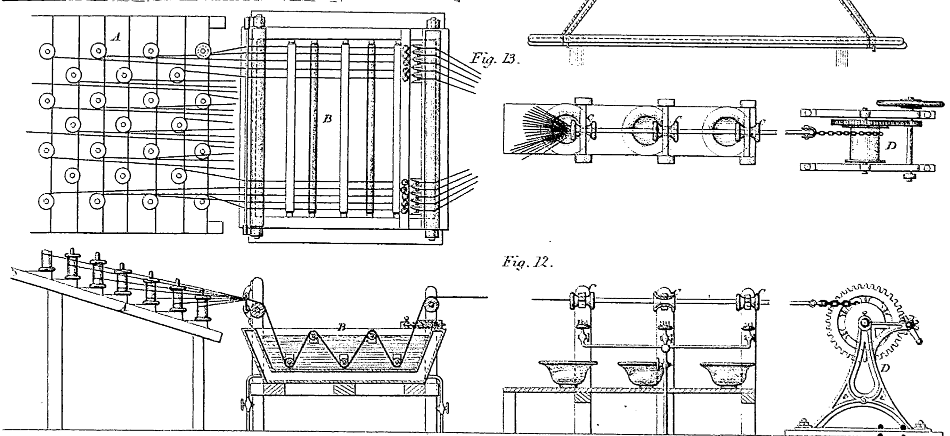
Browne's imp.ts in weaving, &c.



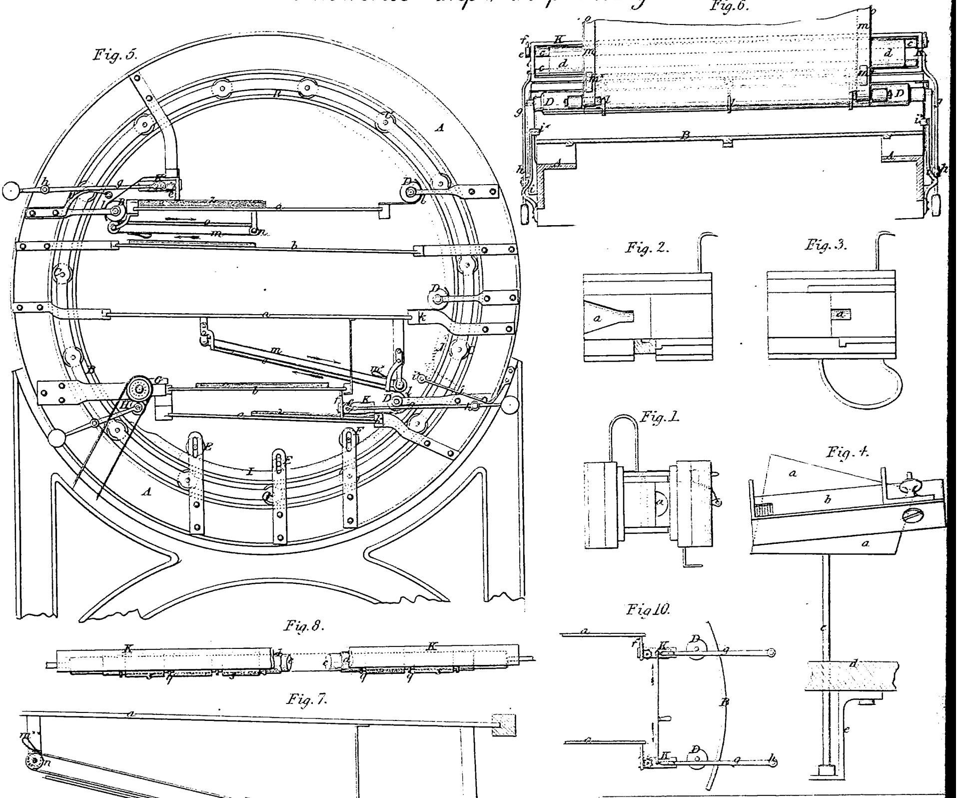
How's salinometer.

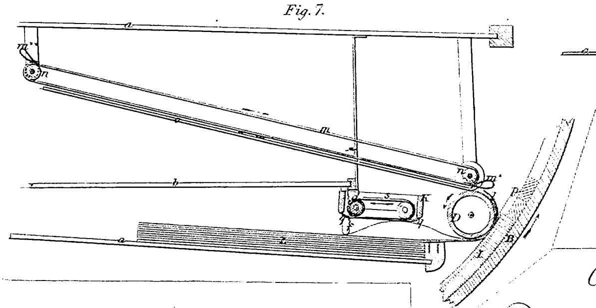




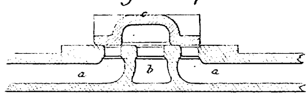


Beniowski's imp.ts in printing.

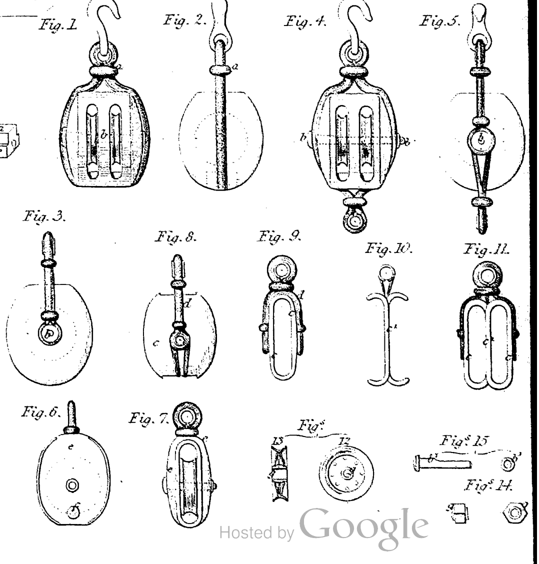




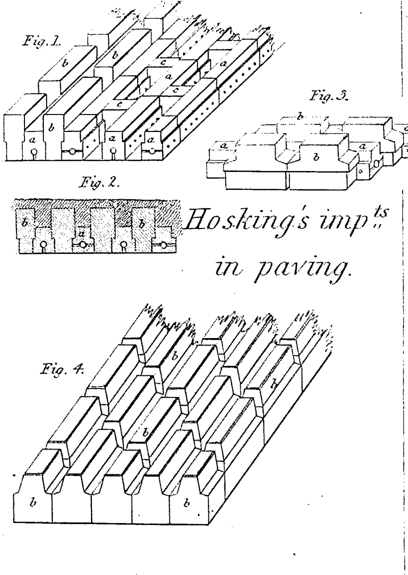
Mulbery's imp.d valve.



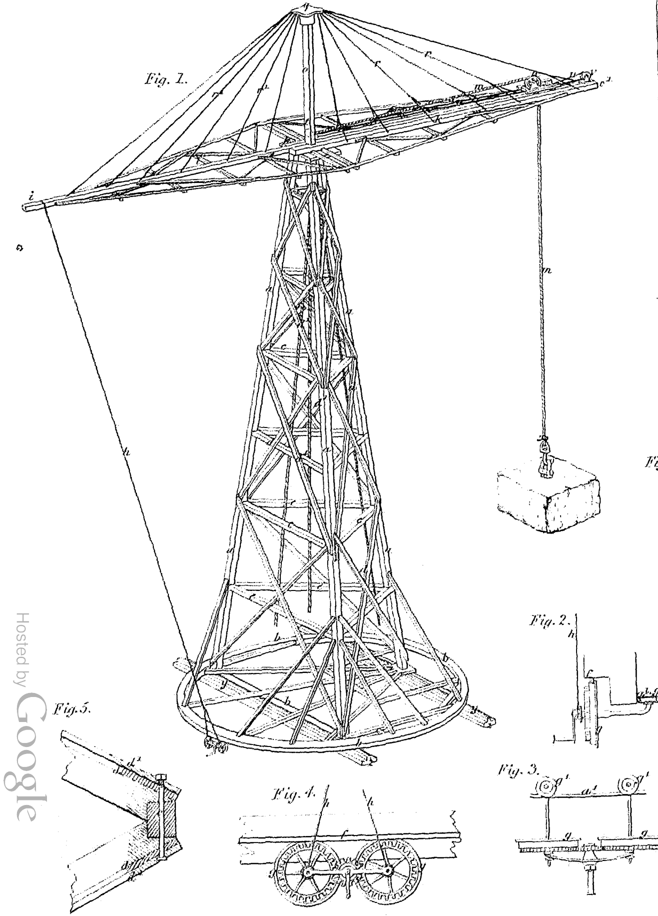
Chamier's ships blocks.



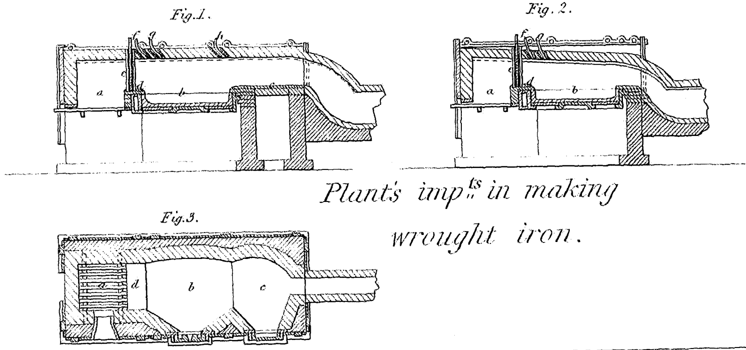
Hosking's imp.ts in paving.



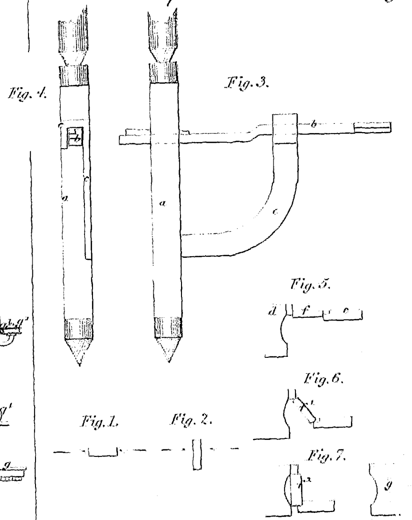
Newton's imp.ts in derricks.



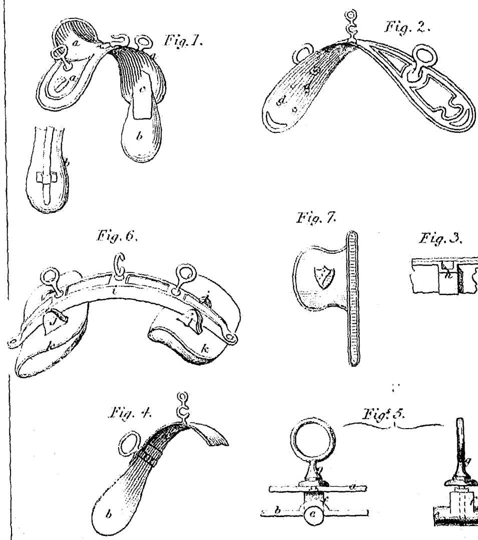
Plant's imp.ts in making wrought iron.



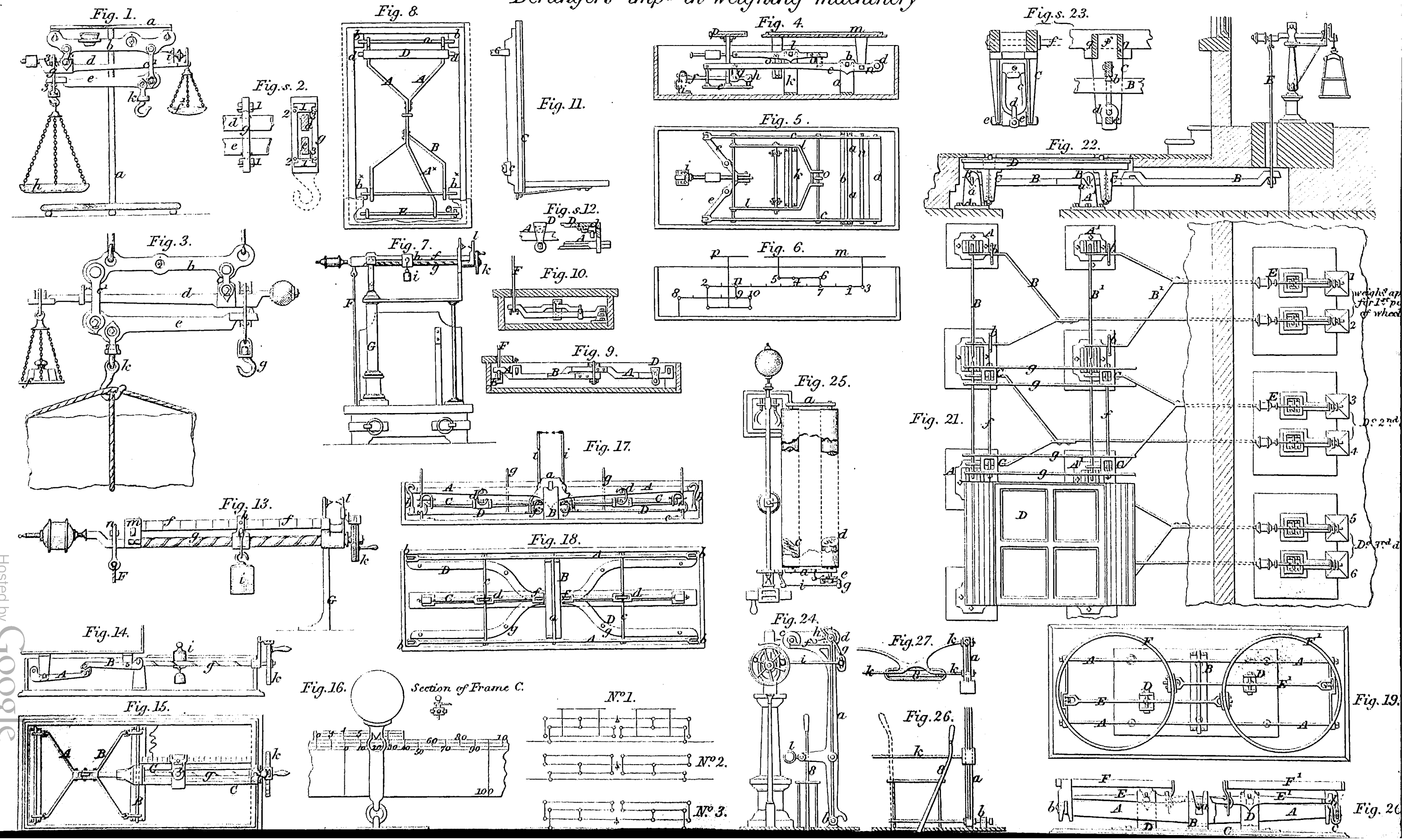
Goose's imp.ts in nail making.



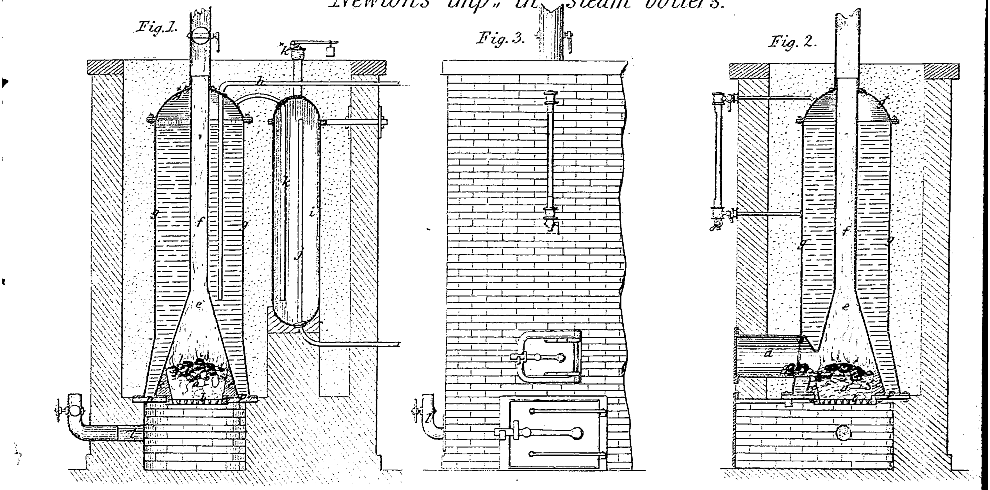
Brooman's imp.ts in saddles.

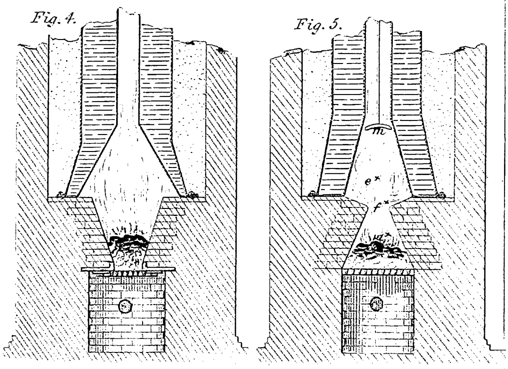


Béranger's imp[ts] in weighing machinery

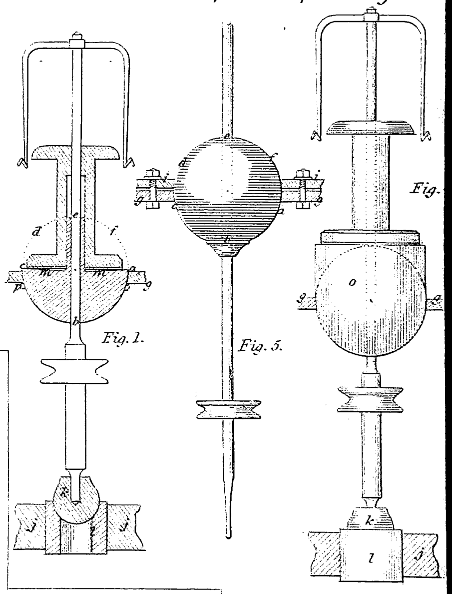


Newton's imp.ts in steam boilers.

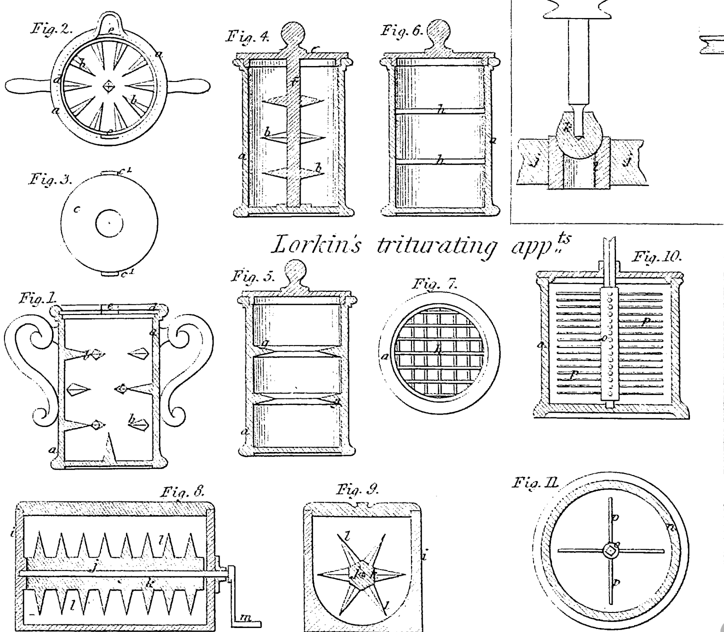


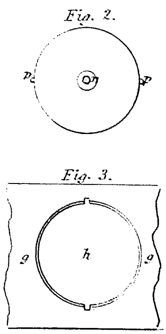


Ermen's imp.ts in spinning.

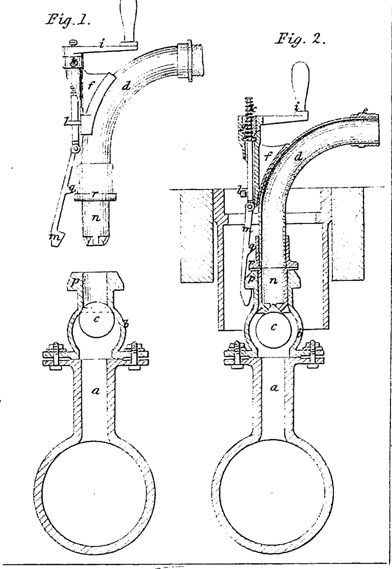


Lorkin's triturating app.ts

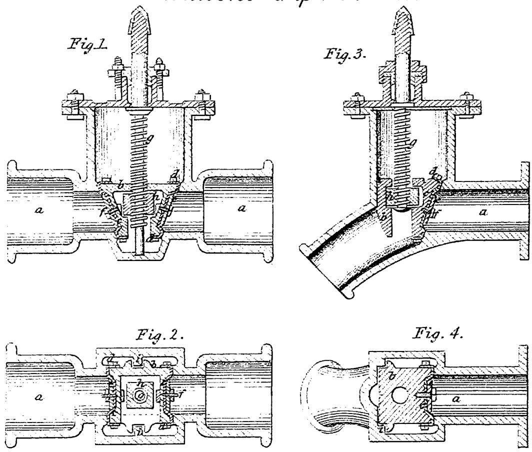




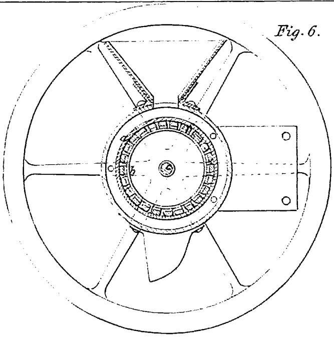
Bateman & Moore's impd. plug.

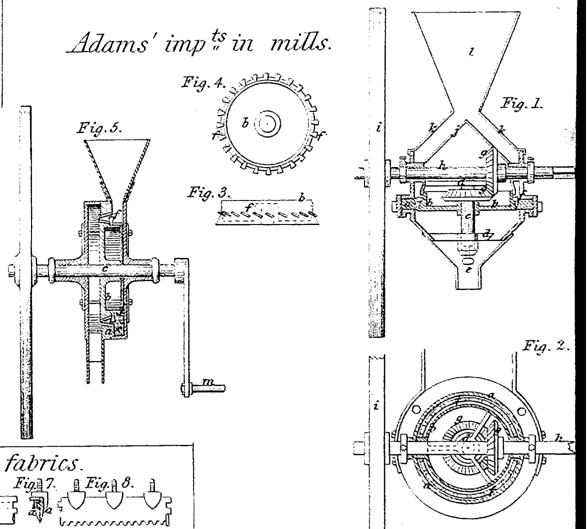


Watson's impts. in valves.

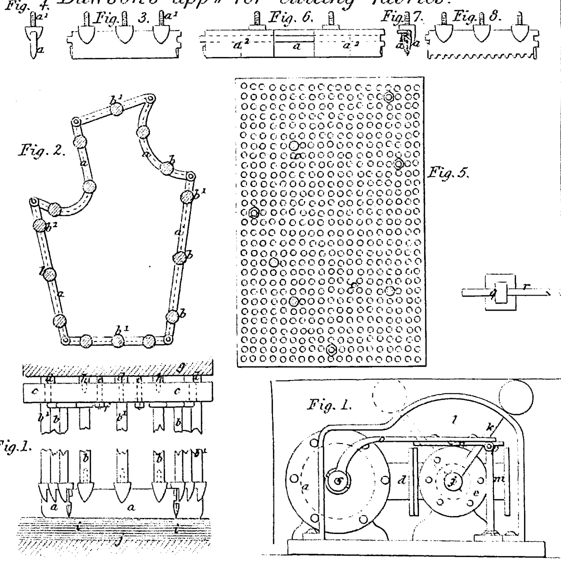


Adams' impts. in mills.

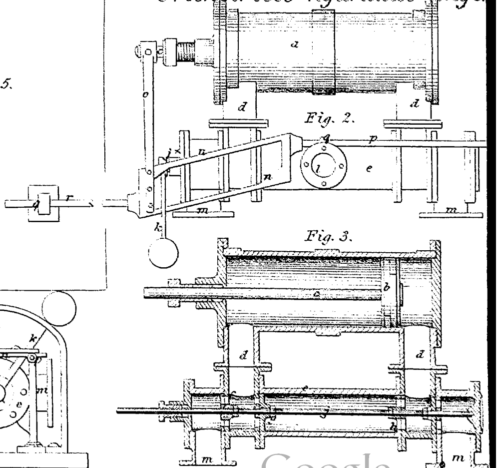




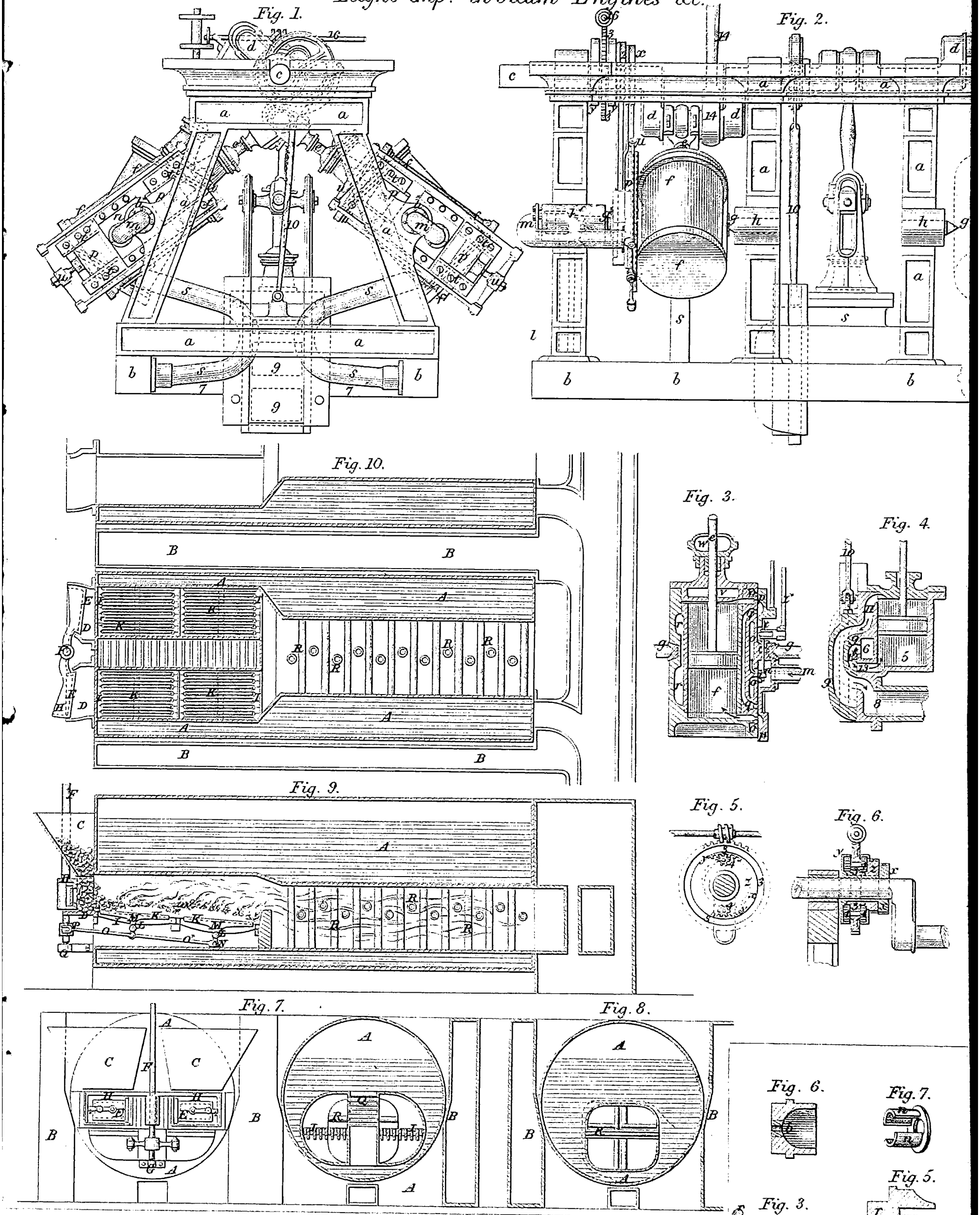
Dawson's appts. for cutting fabrics.



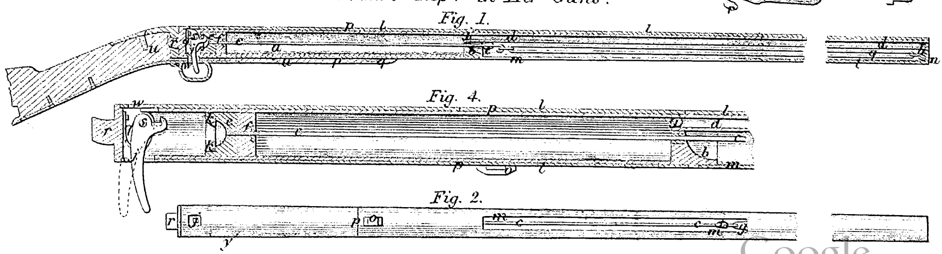
Greenstreet's hydraulic engi



Leigh's imp.ts in Steam Engines &c.

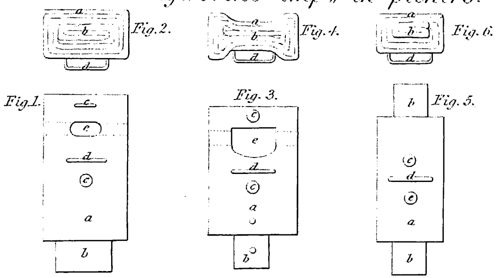


Shaw's imp.ts in Air Guns.

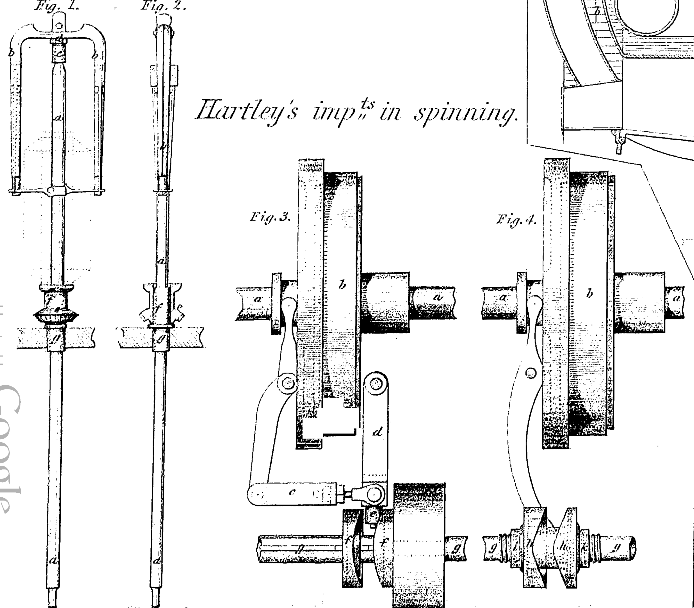


W. Newton del.t 1.st June 1850. W. A. Beever.

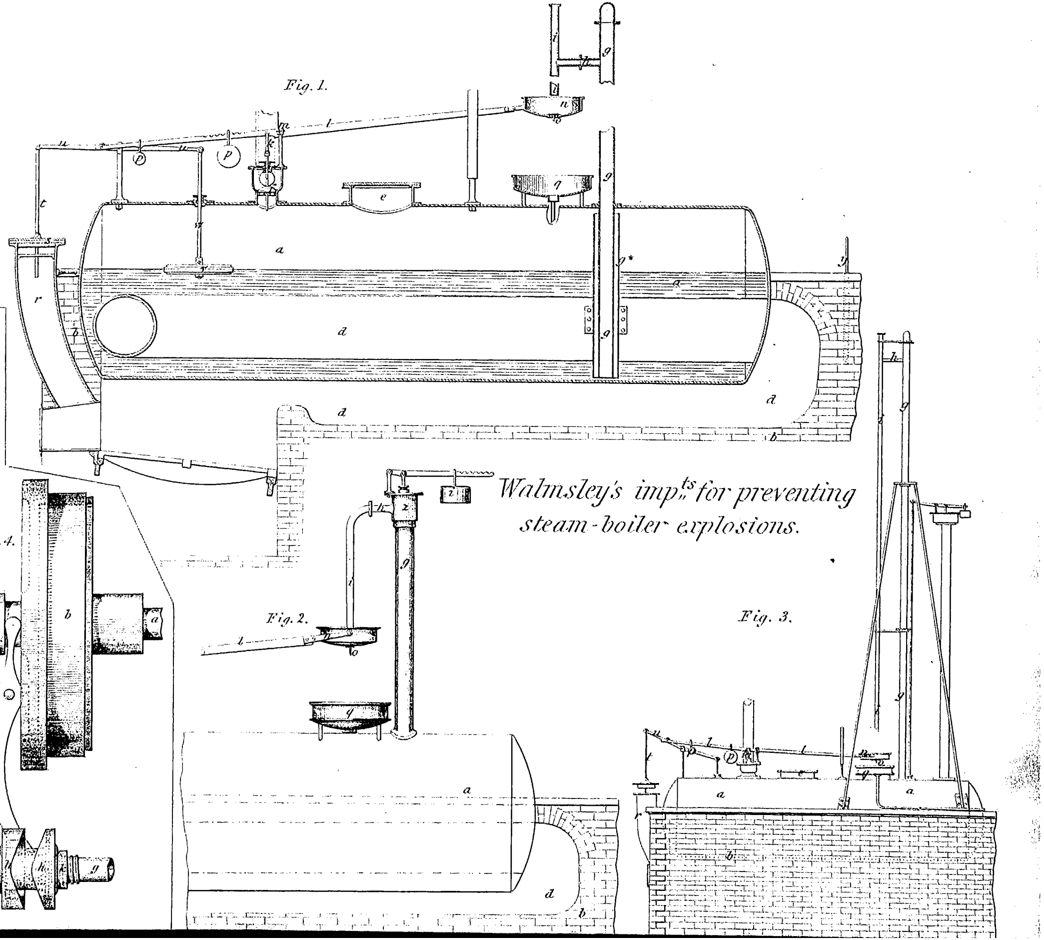
Longworth's imp^{ts}. in pickers.



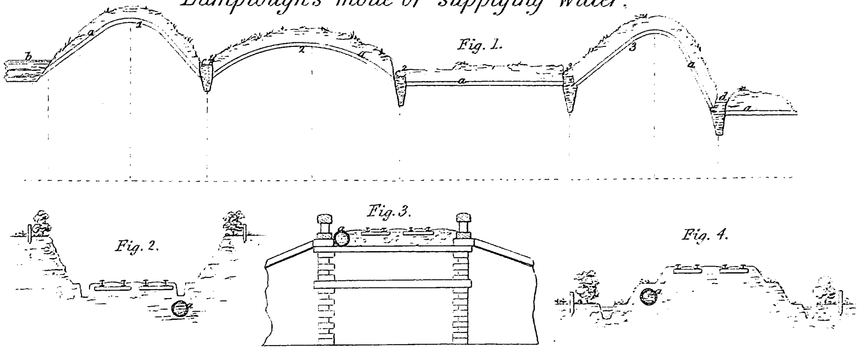
Hartley's imp^{ts}. in spinning.



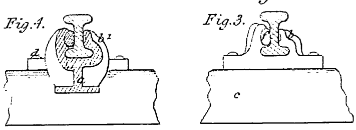
Walmsley's imp^{ts}. for preventing steam-boiler explosions.

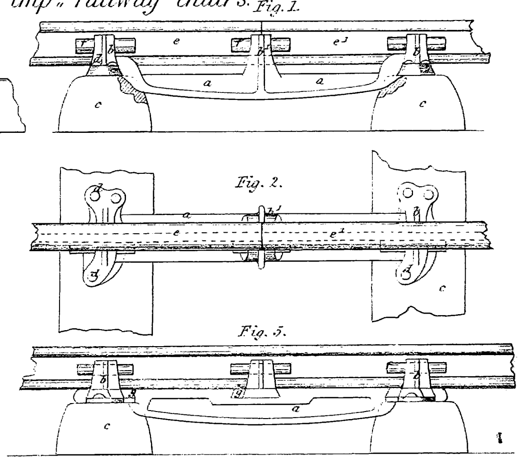


Lamplough's mode of supplying water.

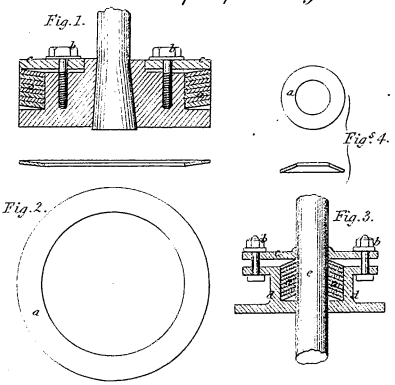


Torkington's impd. railway chairs.

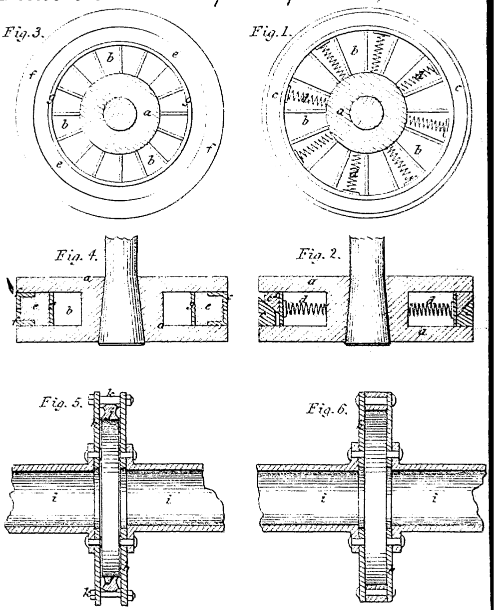




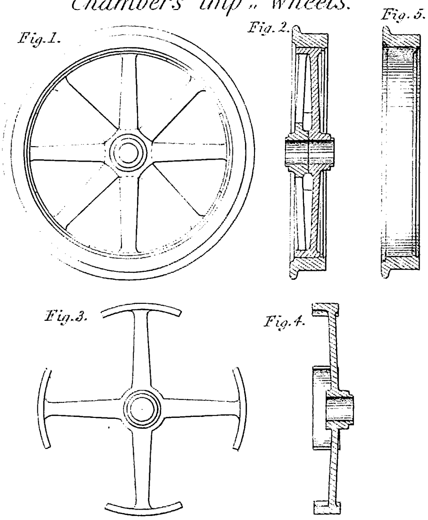
Gillett's impd. packing.



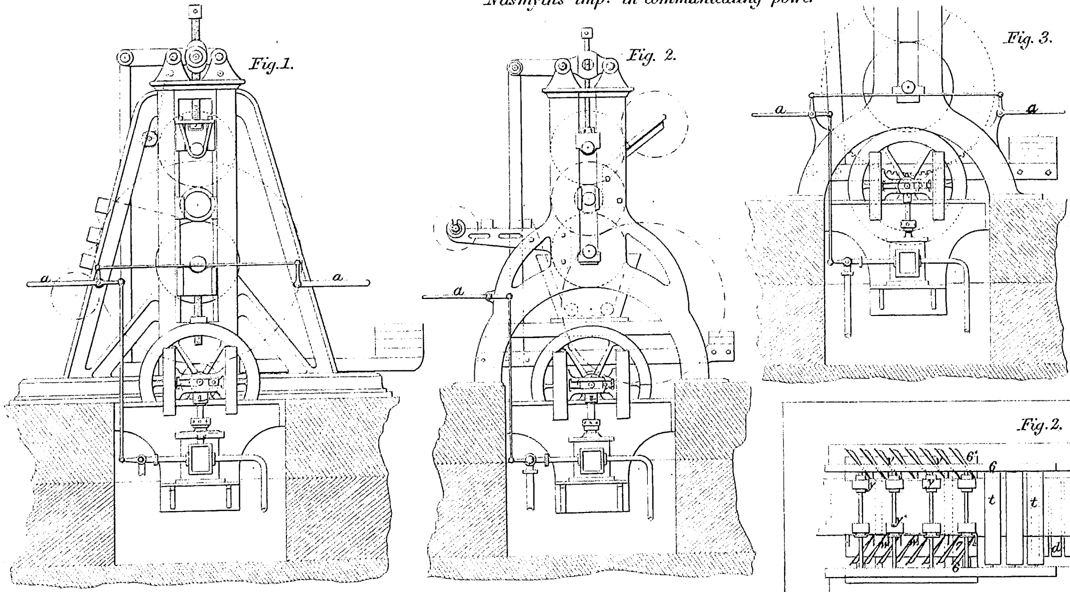
Peace & Evans' impts. in pistons, &c.



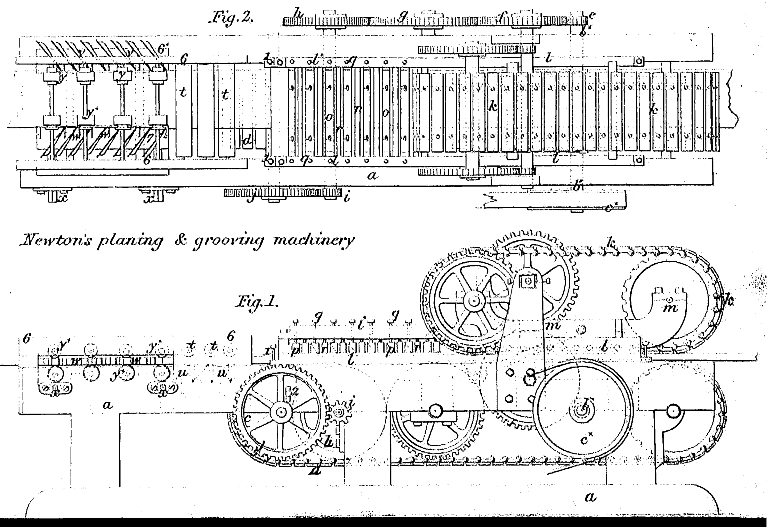
Chamber's impd. wheels.

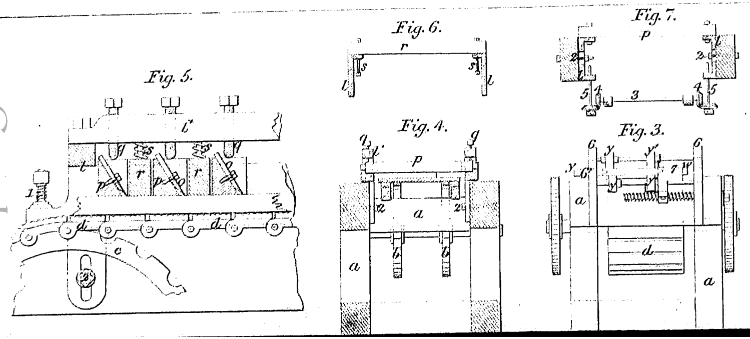


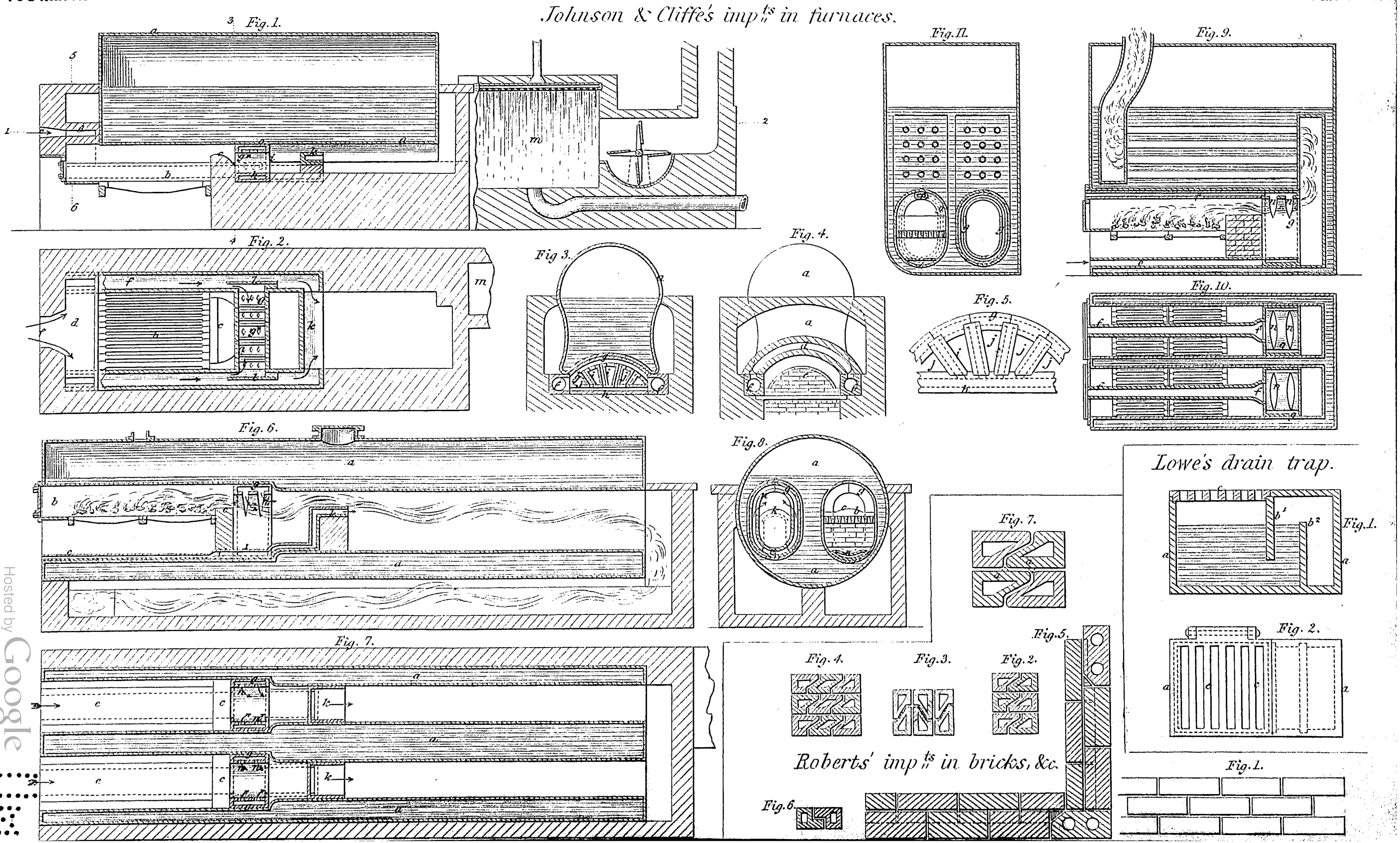
Nasmyth's imp.ts in communicating power



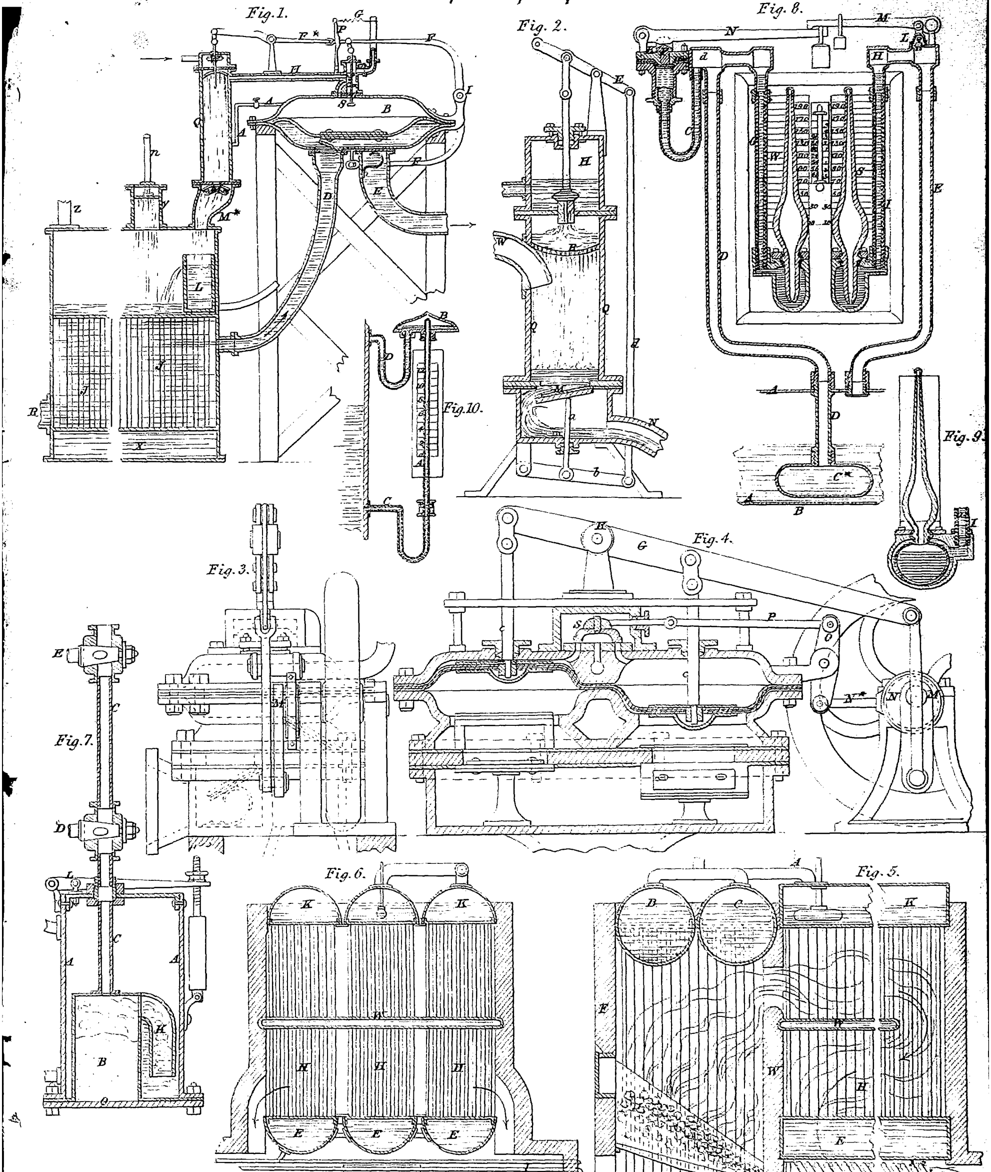
Newton's planing & grooving machinery

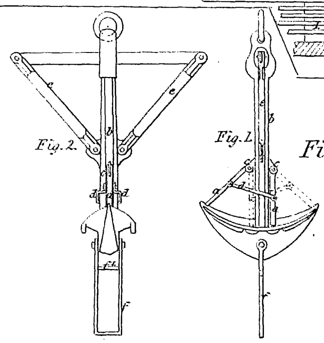





Johnson & Cliffe's imp^ts in furnaces.
Fig. 1.
Fig. 2.
Fig 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Lowe's drain trap.
Fig. 1.
Fig. 2.
Roberts' imp^ts in bricks, &c.
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.

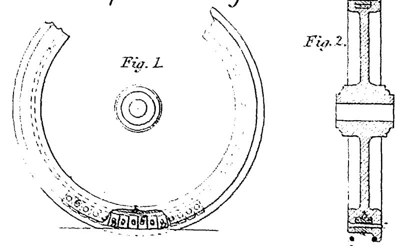
Newton's imp.ts in pumps, boilers, &c.





Field's imp.ts in anchors.

Donisthorpe's railway wheels.



W. Newton del.

1st July 1850.